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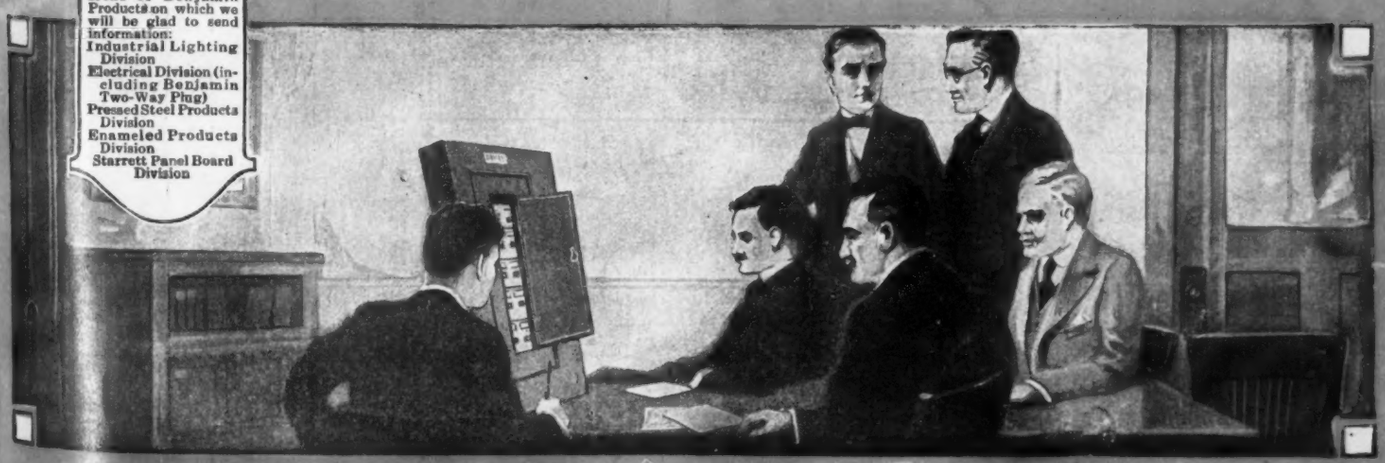

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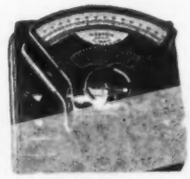

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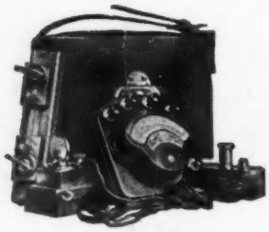

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 75 New York, Saturday, May 1, 1920 *Number* 18

Western Ideas in Utility Financing

SO LONG as electric public utility companies remain unable to finance themselves adequately, expansion of the entire electrical industry will be handicapped. For of what use are motors and appliances if there is no electric service?—and electric service in this day and generation presupposes an electric central station with its transmission and distribution lines. Now, whatever difficulties an Easterner may have in proving this relationship, a Westerner, and especially a Californian, has none, because there is no escaping the fact that the growth of California is intimately associated with and dependent on the continued growth of the electric public utility companies within its borders. Hence the necessity of expansion of electric public utilities in the state, and hence also the interest in the method pursued by the San Joaquin Light & Power Corporation as outlined by A. Emory Wishon of that company in this issue. While the idea has been worked out in Fresno, it is applicable to any other city in the country, and the plan may be copied by other utilities with profit to themselves and the communities which they serve.

A New Field for Electrical Men

WHEN handled by an experienced operator the electric furnace produces a higher quality of steel, brass and other non-ferrous metals than the older processes. Skill in electric furnace operation, however, is one of the factors on which an approximation to 100 per cent quality depends. At present electric furnaces are being installed faster than operators are being trained, with the result that there is an urgent need for men who can fill the position of metal superintendent. This work calls for a knowledge of electric furnace designs, a practical understanding of central-station operation and the problems of furnishing service to furnaces, a working knowledge of metallurgy and ability to handle furnace operators or melters. To students in electrical engineering who are being graduated this year the position of metal superintendent offers an interesting future leading to responsibilities commensurate with initiative and ability, for the extent of applications of the electric furnace and all the uses of its products are by no means yet known.

Cumulative Effect of Electrical Aids

INCREASED production follows the installation of electrical service in countless examples, but the effect of adopting electrically operated equipment is often more far-reaching. Thus the industrial electric truck quickens the loading and unloading of freight cars, road trucks and vessels, cuts down demurrage charges, and through release of vitally needed transportation equipment adds to the nation's capacity for moving men and materials. At a time of disturbances in rail transportation and car shortage like the present who can measure the economic value to the country of every such electrical labor and time saving device enlisted and mobilized for intensive service?

Training the Electrician's Helper

THERE has always been a shortage of first-class electricians in industrial work. The policy of a majority of the plants has been rather indefinite as regards the training of their unskilled hands working as helpers to wiremen. Under present conditions it would appear that a more definite policy along educational lines would be a good plan purely from a business standpoint. When a young man who has been driving a team or following some such occupation joins the "gang" he is usually left to his own fate as to whether he absorbs enough knowledge from his companions to reach finally a stage where he is competent to handle a job on his own responsibility. It is not unusual to find that he is discouraged or rebuffed if he attempts to find out the why and wherefore. Journeymen are sometimes prone to think that any knowledge they have is their own personal property, forgetting that they acquired most of the information they possess through association with their fellow workers. Some plan whereby these beginners could be helped along by schools of instruction during working hours and encouraged to take an interest in their work may prove a solution of the replacement problem, which is becoming more acute as the industry expands.

Solving the Daylight-Saving Problem

IT IS becoming more and more evident that a thorough investigation of the daylight-saving question must be made, based on fundamentals, and that there are going to be dissatisfaction and waste until a solution is worked out. The rejection at Washington of the daylight-saving bill in no way changed the minds of the adherents of the bill. Some state legislatures have enacted laws to straighten the matter locally, while others are planning to do so. More and more cities and their councils are favoring the fast time, while strenuous objections to such time come from farmer organizations. Valuable information may be obtained from some of the European countries that seem to have solved their daylight-saving question. Our problem, however, is distinctly more complicated, since people all along the thousands of miles that separate our eastern and western shores must be satisfied. There has been a great amount of loose talking and very little serious investigation. Preston S. Millar's paper before the midwinter convention of the American Institute of Electrical Engineers very ably pointed the way in which to attack the problem. We

need more work of this nature. It should be pointed out that daylight saving is the concern of the engineer. It is his duty to solve the problem, not so much because there is a small saving of energy possible but mainly because it will take the engineer's training to carry on the investigations, to compile the data and to draw the conclusions.

A Current Balance for Meter Calibration

IN CALIBRATING and checking alternating-current measuring instruments of the ammeter and watt-hour-meter types it is very advantageous to provide a suitable range of testing-current strengths, with a suitable degree of precision. Otto A. Knopp describes in an article this week a very convenient apparatus for providing such a current range, utilizing the well-known principles of the alternating-current current transformer. By suitably designing the transformer, an extended range of alternating-current testing-current strengths on closed circuit can be obtained with practically constant precision. By this means the testing set required for checking and recalibrating ammeters, wattmeters and watt-hour meters can be made very compact and easily controlled. The plan will commend itself to the attention of central-station meter-testing departments.

Electric Furnace Leads

GREAT care must be exercised in designing the leads of electric furnaces in order to keep the circuits in balance and the inductance to the lowest feasible value. Electric furnace practice differs from most other branches of engineering in the relatively large currents which have to be carried, from 10,000 amp. to 50,000 amp. in each unit. Obviously, when currents of this magnitude are to be considered the ordinary skin effect becomes a very large factor in the resistance of the conductors. At 60 cycles, for example, a 2-in. (5-cm.) solid conductor shows about 75 per cent increase over its direct-current resistance. From this standpoint a conductor of round cross-section is the worst possible, and the best, when the return circuit is close, is a thin, flat sheet. The result is that by using a solid conductor built up of thin sections with ventilating spaces between, the current-carrying capacity and effective conductivity are both materially increased. Likewise, in these low-tension leads the interlacing of the positive and negative bars tends to keep down the inductance, and this interlacing even in the short run between the transformer and furnace is advantageous, although at the furnace the leads must of course be separated in order to form the connection with the flexible cables.

In an article in this issue by C. B. Gibson this whole matter is gone into in a very striking and interesting way, showing the scheme of carrying out effectively the subdivision and interlacing of leads necessary to limit the effective resistance and improve the power factor. Failure to appreciate the importance of this matter is quite capable of leaving the furnace short of power and of seriously injuring transformer and generating apparatus. The electric furnace is one of the relatively few appliances in which sheer magnitude of current leads to engineering problems of a very serious nature.

The Graduating Class of 1920

THE young men who will be graduated in electrical and mechanical engineering next June are in an exceptional position as regards the opportunities for choosing a preferred line of work in a preferred location. There is an unprecedented shortage of young engineers in practically all lines of work. Manufacturing companies, operating concerns, sales organizations, telegraph and telephone companies all began sending their representatives to the principal colleges of engineering before New Year's, apparently in accordance with the old adage about the early bird and the worm.

The results so far have hardly been gratifying from the point of view of either the companies or the students. It seems to be a case of unrestricted competition which demoralizes both the seller and the buyer. The companies will adjust themselves in time when the present feverish period of activity is over, but the young graduates may become imbued with an exaggerated notion of their importance and of the need for their services. This notion may warp their sound judgment and true perspective of things for many years to come.

Confronted by numerous offers of employment, bewildered by alluring pictures of the type of the army recruiting posters, seeing many notices on the employment boards, receiving letters and telegrams from the representatives who interviewed them, the present seniors have been literally taken off their feet. The quiet scholastic atmosphere is gone and with it much of the inducement for hard study. The regular schedules are disturbed by interviews with the representatives and by "talks" given by them. The spirit of gambling and of getting the best bargain is rampant, and as a result the best part of the senior year with its special advanced studies is largely wasted.

Even though this situation may never repeat itself, even if the graduates of the future will have no such extraordinary choice of jobs, it still remains a pity to see the present scramble for employees involving thousands of young men who each can have a job for the asking and who in the meantime can waste their time in college. The young men are not in a position to change the abundance of luck that confronts them, even if they wished to. It is for the employers and for the administrations of the engineering colleges to adjust the conditions.

Another undesirable feature of the situation is that in this competitive bidding for young graduates the industrial concerns are forced to offer compensation far higher than the knowledge or the ability of the men would entitle them to. Moreover, the companies cannot consistently pay this higher compensation to new men without raising in proportion the salaries of the older men doing similar work. Thus the operating expenses are unnecessarily increased at a time when the efforts of the best managers of industry are directed toward a gradual reduction in expenses with a corresponding decrease of the market prices of essential commodities. During the war we were short of bread and coal, and so the powers that be designated priority and limited consumption in a well-regulated fashion. We are now short of young engineers, and a proper central body should regulate their employment and not permit them to be debauched by competitive offers; for human lives are infinitely more precious than flour or coal.

Visual Instruction from Load Curves

THE trained eye gathers much from the load chart or daily record of the power company without taking the time to analyze the actual reason for the impression as a whole. By cutting out the daily charts and keeping them in specially prepared receptacles year in and year out unusually instructive hills and valleys appear that offer a perspective in power study difficult to duplicate. Those companies that have followed the practice of keeping their load charts in this manner have found that they serve as useful studies for many departments in the power company organization. Such charts are particularly to be commended at this time where there is a shortage of power on systems covering large areas of country dependent on both hydro-electric and steam electric supply and where a wide variation in power consumption is to be found. Under such a system of visual instruction the eye can at once detect the effect of a rainfall in the mountains or the falling off in power uses for railway electric power supply due to an epidemic such as influenza. Even a street-railway strike is at once reflected in the configuration. The demands of the hour in industrial activity make necessary the invention of means by which a fuller and better perspective may be had in all factors affecting industry. In the electrical industry the load curve can be made truly instructive by properly filing the daily report, and its wide use is to be commended.

Why This Indifference to Plant Maintenance?

IT IS surprising and disappointing to find numerous large industrial plants which have so little regard for the welfare of their electrical equipment that they will not employ an electrical man to superintend its operation, inspection, maintenance, testing, etc. That such a condition does exist is known by visits to plants picked at random, some of national note industrially. Some of the plant executives say: "What is the use of engaging an electrical man? All we have to do after the equipment is installed is to throw a switch. We have never had a breakdown in five years." When questioned regarding the attention given the motors, many reply that they give them none. Considering the records of uninterrupted service secured in these plants, the replies are the highest recommendations of the equipment.

Of course, when everything is running properly and there have been no interruptions to production, it is difficult to convince executives who are interested solely in production in the regular inspection and maintenance of electrical equipment. If they can't be made to visualize the losses which might be incurred by a possible breakdown (even electrical equipment cannot be abused forever), the opportune time to convince them that such work is important is immediately after an interruption in production. Then the expense for an inspection and maintenance crew can be shown in its real proportions and justified if ever. In this connection it is interesting to note that one large industrial plant was able to eliminate breakdowns and electrical maintenance expense almost entirely by inspecting equipment periodically to forestall trouble.

While production has been the chief consideration of industrial plant executives, economy should no longer be overlooked. One of the best ways to check economy of energy consumption is to provide meters which can be switched into any circuit quickly or to make periodic tests with portable apparatus. With the information thus obtained the electrical engineer can suggest better grouping of machines (as regards motor drive) that will improve the power factor, reduce the demand charge, enable a plant to get along with the least investment in motors, etc.

Like a few other services, unfortunately, an inspection department is never appreciated until it has once been tried and has to suspend or curtail operations for some reason or other. Then the recognition of its value is expressed in the form of "Why didn't you attend to that bearing?" or "Why didn't you replace that motor by one better adapted to the load before we were forced to shut down the whole department?" The moral is for industrial executives to study the excellent results that other companies have secured through their electrical organizations.

Overhauling Hydro-Electric Plants

MUCH attention is at present being given to the subject of overhauling hydro-electric plants. The shortage of power due to the postponement of the power development program during the war period and the subsequent enormous increases in power demand, coupled with the shortage of rainfall in certain districts of the nation, makes this a timely and interesting engineering topic.

An instance of what has been found possible along this line of economic salvaging is afforded by one of the hydro-electric power plants of California, namely, that of the Stanislaus development of the Sierra & San Francisco Power Company. In this particular instance two penstock pipe lines were originally designed to convey sufficient water to develop 20,000 kw. with a friction loss of 5 per cent. It is now found possible at certain periods to develop as much as 33,000 kw. with the same installation, but under such circumstances the friction loss in the penstock pipes is increased to from 13 to 14 per cent. As a consequence this company has undertaken the installation of additional power-plant facilities which will extend the installed capacity of this power plant to 40,000 kw. without increasing the actual water development formerly existing in the ditches and canals. This is brought about largely by the installation of a third penstock pipe, thus increasing the pipe line capacity by 50 per cent. By making use of the forebay facilities feeding into the penstock pipes a saving of peak to the extent of about 3,000 kw. will become possible, and an actual saving in energy of over 600,000 kw.-hr. will be realized.

In other districts of the West the overhauling of flumes and a slight changing in grades in many instances are also aiding in power development, though otherwise uneconomical. Taking it all in all, power companies will do well in these times of emergency to view with considerable care the possibility of increasing power development by taking advantage of economies and slight increases in power outlay already existing and thus bringing about new and enlarged installation capacity. This, too, applies to the overhauling of hydraulic machinery, the readjustment of blades, the cleaning of turbine wheels and all the other factors that go toward increasing the efficiency of operation on down through the generating apparatus.

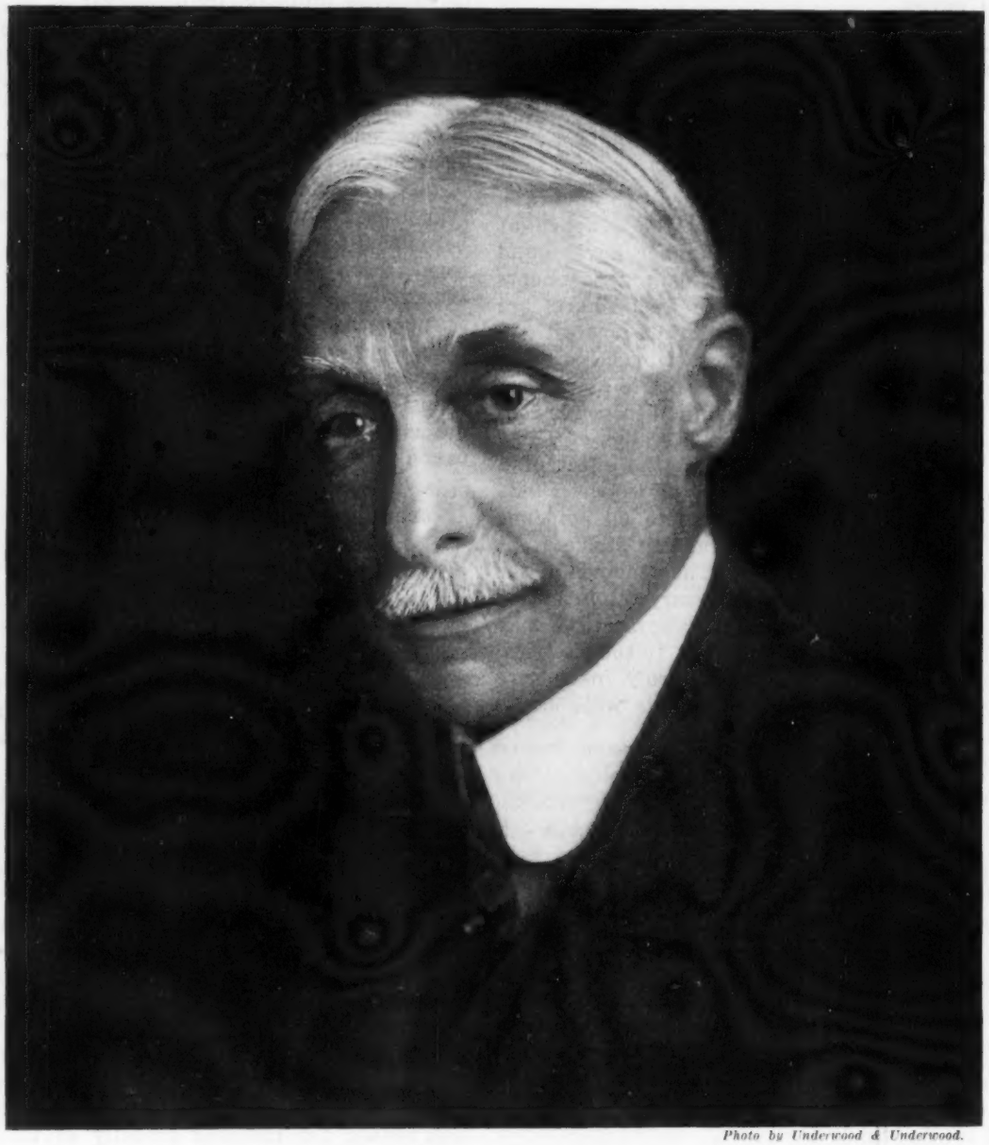


Photo by Underwood & Underwood.

Elmer Ambrose Sperry

An engineer and inventor of remarkable versatility, the holder of patents covering electric lighting and transmission, electrically operated mining machinery, electric railways, electric vehicles, electrochemistry, ship navigation and searchlamps

THE numerous inventions of Elmer Ambrose Sperry, president of the Sperry Gyroscope Company, date back to the early days of electric lighting. In 1879 he produced an arc lamp and system of lighting and soon after secured patents on motors, generators and regulators. In 1880, when twenty years old, he organized the Sperry Electric Light Company in Chicago to produce apparatus and machines from his designs. For the Board of Trade in that city he erected in 1883 the first high-powered electric beacon, consisting of a steel tower 303 ft. high, carrying twenty arc lamps of 40,000 cp. A few years later he became interested in mining operations and was the first to apply electricity in the operation of mining machines, such as pick cutters, chain cutters, etc. He also developed an electric locomotive which found application in electric railway work and caused the founding of the Sperry Electric Railway Company in Cleveland, Ohio. His patents controlled by this company were purchased by the General Electric Company in 1894. When the automobile industry was born Mr. Sperry designed and built a successful electric car.

In 1890 Mr. Sperry began the work that has brought him the greatest fame, the commercial applications of the gyroscope. First came the gyroscopic compass, then the use of the gyroscope for stabilizing ships—a field in which commercial failures had marked the efforts of other inventors. Mr. Sperry's methods have not only proved successful on very large ships but apply equally well to aeroplanes. This work has been widely recognized by many medals and honorary awards. Important among his recent developments are inventions covering searchlamps that produce an intense beam, as high as 500 cp. per square millimeter. In the electrochemical field he has also done much original work and his patents are employed by several prominent companies.

Mr. Sperry was one of the founders of the American Institute of Electrical Engineers and the American Electrochemical Society and chairman of the committee that called the first meeting of the National Electric Light Association. He is also a member of the American Society of Mechanical Engineers, the Naval Architects and Marine Engineers and several other semi-technical organizations. During the war Mr. Sperry rendered valuable service to the government as a member of the Naval Consulting Board. On Oct. 12 of this year he will celebrate his sixtieth birthday.

Interlacing Furnace Transformer Busbars

Heavy Currents Make It Necessary to Consider Cross-Section, Shape and Relative Position of Conductors—Induction Reduced by Interlacing

By C. B. GIBSON
Westinghouse Electric and Manufacturing Company

IN ELECTRIC furnace installations, where heavy alternating currents are involved, the difficulties of conducting the current from the transformer to the furnace terminals are very pronounced and unusual care must be taken in arranging the low-tension buses. Two essential requirements are: (1) That sufficient cross-section be provided to conduct the extremely heavy current without excessive heating and energy loss; (2) that the conductors be so arranged that the inductance of the circuit will be a minimum.

A factor that is of decided importance in determining the proper cross-section of conductor is "skin effect," or the tendency of alternating current to seek the section of the conductor nearest the surface. When currents of from 10,000 amp. to 50,000 amp. are used, therefore, conductors large in cross-sections are required, for alternating current does not take full advantage of the conductivity of an ordinary conductor. It does not distribute itself uniformly throughout the cross-section but favors the area near the surface and shuns that near the center of the conductor. This is due to the fact that it encounters less inductance and impedance near the outer surface than it does near the center, and it is for this reason that large cables are often built up around a non-conducting core.

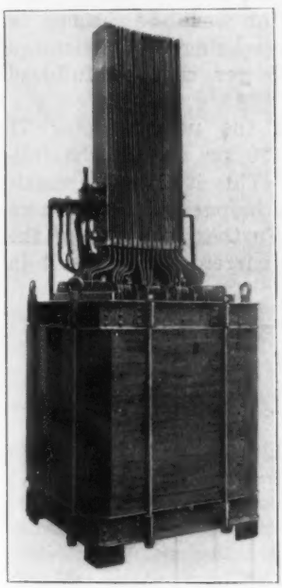


FIG. 1 — COIL ENDS ARE BROUGHT OUT INTERLACED AND CONTINUED TO A POINT NEAR THE FURNACE

With cylindrical copper conductors of ½ in. (1.25 cm.) or even 1 in. (2.5 cm.) in diameter, the "skin effect" at 25 cycles is negligible, but with a 2-in. (5-cm.) conductor it reaches such a value that the effective resistance has increased approximately 25 per cent over the corresponding resistance to direct current. With 60 cycles, the ½-in. cylindrical conductor offers a small increase in resistance to the passage of alternating current, the 1-in. conductor has an 11 per cent increase and the 2-in. conductor has approximately a 75 per cent increase over the resistance to direct current. From these figures it will be seen that a solid cylindrical conductor with a diameter slightly over 2 in. offers virtually twice the resistance to a 60-cycle current that it does to direct current. For copper and aluminum sections of equal resistance the increase in resistance to alternating current is practically the same, but for conductors of the same cross-section it is less for aluminum. These values are true regardless of current density used.

In addition to the sectional area of the individual conductor, the shape must also be considered when heavy alternating currents are to be transmitted. For a given cross-section area of conductor, as far as effective resistance is concerned, the poorest solid section form is round, and the best, where the return is near, is a thin flat sheet. If a solid cylindrical conductor be rolled into a sheet and then formed into a thin walled tube of the same cross-section area the effective resistance of the tube will be considerably less than that of the solid cylinder. By separating a solid conductor into sections, with ventilating spaces between them, the current distribution or effective resistance is not affected, but the current-carrying capacity is increased.

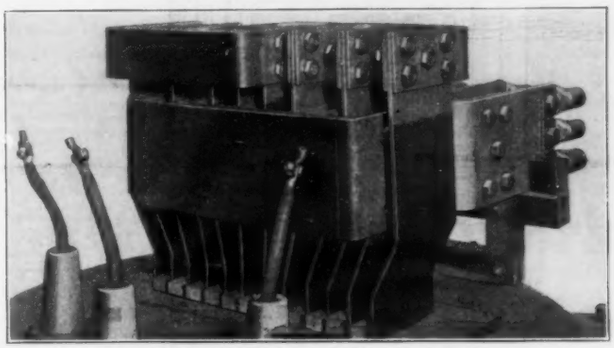


FIG. 2—FORMING THE DELTA ON THE TRANSFORMER

In case the transformer can be installed near the furnace the delta is made up on the transformer and the furnace flexibles carry the current to the furnace.

With the shape of the conductors determined so that they will be used to the best advantage without excessive heating, the next problem to be solved is to insure the proper relative position of the positive conductors with respect to the negative conductors so that the inductance of the circuit will be kept at a minimum. Current distribution within a conductor is also affected by an adjacent conductor of opposite polarity, as the current tends to take the surface near to it. This is because on the near surface the mutual inductance is at a maximum and it therefore has a greater effect in reducing the self-inductance.

Effect of Interlacing Leads on Reducing Inductance

Low-tension leads of furnace transformers are generally interlaced alternately positive and negative when brought through the transformer case. In this way the inductance of the leads is kept at a minimum because of the subtractive effect of the mutual inductance of adjacent bars of opposite polarity. Because of this the resulting inductance of a negative bar, with a positive bar placed on both sides of it, is considerably reduced by the mutual inductance subtracting from its self-inductance.

This condition also holds true for the bars after they

leave the transformer so that they should be kept interlaced to a point as near the furnace as is possible, where it is necessary to separate the leads and form the delta connection for the flexible cables. By this method the inductance of the interlaced section will be very small as compared with that of the section where

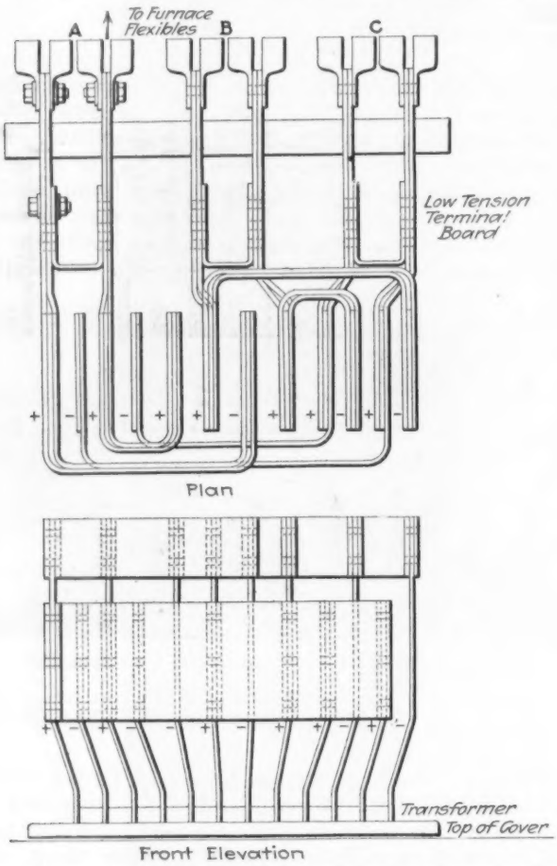


FIG. 3—DETAIL LAYOUT OF DELTA FORMED AT TRANSFORMER

the leads are separated for the flexible cable running to the furnace mast.

In an installation where the transformer can be placed very near the furnace the delta connection can be made at the transformer terminals on top of the tank, and in this case the flexible cables will run from here directly to the furnace mast. With this method the total distance from the transformer to the electrodes must be kept low as the inductance of the circuit increases rapidly where the phase leads are separated and not interlaced. These same methods apply equally well for a star or "Y" connected secondary, the star connections being made either at the end of the interlaced run or on top of the transformer case.

Because the low-tension run is usually short transposition of the busbars is not considered necessary. However, it is desirable if possible, for with three separated phase groups of bars in one run the two outer groups will have a greater inductance than the center group.

Where transposition is advisable and feasible it should be within each phase group of the flexible cable, so that each cable will have an equal impedance and there will be no excessive heating in some of the cables. The aim is to have each cable of the group kept in the same average relative position over the run, and if this condition is obtained, then each cable will take an equal current and there will be no excessive heating.

To illustrate some of the limitations encountered in practice, a furnace installation will be assumed operating at 100 volts, 25 cycles, with the conductor arrangement and service such that a power factor of 90 per cent is obtained at rated full-load current. By forming a voltage triangle it will be seen that 100 volts, the hypothenuse, represents the applied voltage, and 90 volts, the base, represents the component of voltage in phase with the current. The resultant reactance component is found to be 43 volts. With this same furnace operating on 60 cycles for the same current value, the reactance component will be proportional to the frequency, or equal to 103 volts, which value is more than the impressed voltage. This means that the furnace, even with the electrodes short-circuited, would not quite take full load current from a 60-cycle supply circuit. On 25 cycles, with the electrodes short-circuited, the maximum current that will flow is somewhat less than two and one-half times full-load current.

With a furnace circuit of constant reactance and varying resistance the maximum power input occurs when the reactance drop is equal to the resistance drop, or when the power factor is 71 per cent. With the furnace assumed above this condition would be reached by moving the electrodes and decreasing the resistance until the current reaches 165 per cent of full-load current.

Under this condition, with the power factor 71 per cent, the energy input is 130 per cent of the full-load condition assumed above. This is then the maximum amount of power that can be put into the furnace when operating at 100 volts. Further reduction of the resistance and increase of the current would result in

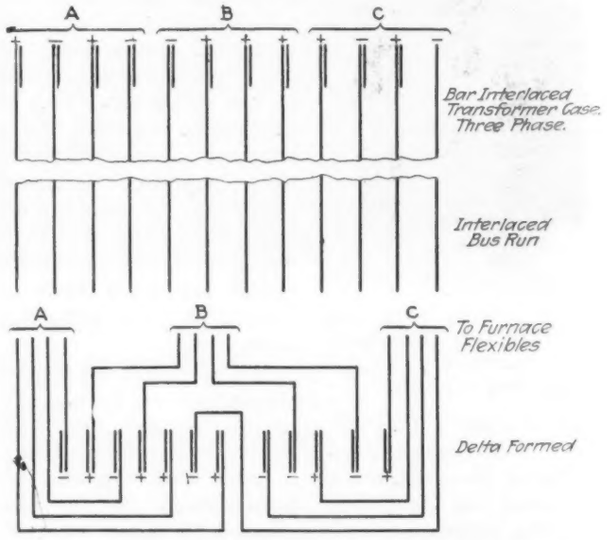


FIG. 4—INTERLACING BUS-BARS FOR A THREE-PHASE TRANSFORMER

There are in this case two low-tension coils for each phase and therefore twelve ends which are brought out interlaced as shown and carried to a point as near the furnace as possible before forming the delta.

such a low power factor that the energy input would decrease below that obtained at 71 per cent power factor.

However, where a power factor of 71 per cent is obtained from a furnace load, it means that the capacity of the electrical equipment must be 141 per cent of that required for supplying the true power component of the load.

From the standpoint of the central station, this

will not be so satisfactory a load as one with a power factor around 90 per cent, nor does the furnace operator care to purchase equipment 41 per cent in excess of his needs and of useless reactive capacity. On the other hand, the arc furnace requires a certain amount of reactance in its circuit which serves to store energy momentarily and return it to the circuit during the period of the cycle when the alternating current passes through zero value. In general, approximately 30 per cent reactance, corresponding to 95 per cent power factor, must be inherent to the electric arc-furnace circuit in order to stabilize its operation. From an electrical standpoint, therefore, the arc furnace should always operate between approximately the limits of 71 per cent and 95 per cent power factor, and commercial furnaces of all types usually do operate within this range.

The heating of electrical equipment is influenced by power factor, and alternating-current machinery is rated according to the product of the volts and amperes (kilovolt-amperes), which takes into account the limiting values of capacity as imposed by the current and its attendant heating effect. This is true not only of generating machinery but also of the transformers. The heating effect of the current is proportional to the square of its value, so that as the power factor decreases losses due to current flowing through the conductors will increase rapidly. Evidently it is an advantage to the furnace operator to secure a transformer of minimum kva. rating which will perform the service. The lower the reactance of the circuit, the higher will be the power factor and the lower will be the first cost of the transformer and the conductor losses. Because of these factors too much care cannot be taken in planning a heavy-current bus layout in order to secure low reactance and a high power factor.

The weight of conductors for heavy current is an important factor and ample provision must be made for their support. Besides having mechanical strength, these supports must serve as insulators, although the potentials involved will not usually be in excess of 100 volts. The necessity for laminating and interlacing the conductors in heavy current work complicate the support problem. In addition, the contacts and connections between different parts of the circuit and the terminals of the apparatus carrying the heavy current must also be laid out with the greatest care.

New Current Balance for Calibration Work

Ammeters, Wattmeters, Watt-Hour Meters and Current Transformers May Be Tested Over Wide Ranges with High Accuracy by Means of a Magnetic Current Balance—Greatly Reduces Time and Tedious Operations Required in Ordinary Calibration Work

By OTTO A. KNOPP
Pacific Gas & Electric Company, San Francisco, Cal.

A TESTING device has been developed by the writer and used extensively in the electrical laboratory of the Pacific Gas & Electric Company which is extremely useful in the routine calibration of ammeters and wattmeters. In testing wattmeters, particularly, the device eliminates much of the time and tediousness of calibration work as usually carried out. It also offers a convenient and absolute method of testing current transformers for ratio and phase angle. The principle is that of a magnetic current balance. The purpose of the present article is to explain fully the principle and applications of this apparatus.

It is well known that if the product of amperes times turns is constant, no matter what the factors are of this product, the magnetic effect under like conditions will be the same. For instance, if we wind a ring-shaped solenoid, of say 1,000 turns, and send a current of 1 amp. through it, we get a certain field inside the solenoid corresponding to the 1,000 ampere-turns. If we wind a second ring-shaped solenoid on and concentric with the first, of say 100 turns, and send a current of 10 amp. through it, we again obtain inside of the solenoid the field due to 1,000 ampere-turns. Then if the two fields are in opposition there will not be any magnetic flux inside the smaller solenoid. This applies to both alternating current and direct current.

The expedient of producing like fields with different currents but equal ampere-turns has been used extensively in this laboratory in the development of new measuring apparatus and numerous test methods. Two of these devices for direct-current measurements were developed some seven years ago, the direct-current line-current testing set and the direct-current ratio relay,* in which an iron ring core, slipped over the conductor whose current is to be measured, is magnetized by the latter and by means of a small current passed through a winding wound around this iron core the magnetic flux is neutralized (see Figs. 1 and 2). In the direct-current line-current testing set the fluxes are balanced by regulating the secondary current by hand (see Fig. 1), and in the other, the ratio relay, the fluxes are balanced automatically (see Fig. 2). In each case the small secondary current is always in a fixed proportion to the current flowing in the conductor, this proportion being the inverse ratio of turns. Where it is not objectionable to open the circuit whose current is to be measured, the iron core is wound with suitable primary turns so as to give these current balances (both the automatic and the non-automatic) numerous current ranges. All that is essential is to wind for each primary range all turns concentric to the secondary winding. In this way it is possible to provide a great many ranges to cover a wide field of testing. The particular advantage of such a multiple-range magnetic current balance over the present multiple-shunt or millivoltmeter measusing outfit is that its accuracy is not impaired by any changes in secondary resistance. It is possible to insert any instrument—indicating, curve-drawing or integrating—without affecting the accuracy of the measurement.

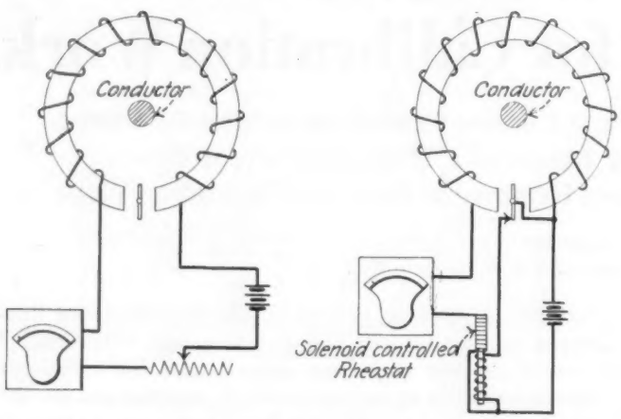
Such a multiple-range or multiple-ratio magnetic cur-

*Described in the ELECTRICAL WORLD, Oct. 2, 1915.

rent balance can also be used to proportion currents in certain ratios as follows:

If a current of known value is passing through a certain range of the primary winding (see Fig. 4), we obtain a fixed secondary current. If we now send a current through another range of the primary winding and make it of such a magnitude that the secondary current is the same again, we shall have established a new primary current, which will bear to the former primary current the inverse ratio of the turns of the two primary windings. For instance, if our current was 50 amp. flowing through 36 turns and we change the turns successively to 45, 60, 90 and 180, then we shall have to change our primary current, in order to keep the secondary current the same, from 50 to 40 to 30 to 20 to 10. In other words, it will be possible, after having accurately measured one value of primary current, to establish with equal accuracy as many other current values as there are sections in the primary winding of the magnetic current balance.

This principle of the magnetic current balance can also be applied to alternating current, using the same apparatus (Figs. 1 and 2), with the only difference that an alternating-current excitation is provided for



FIGS. 1 AND 2—BALANCING AMPERE TURNS FOR CURRENT MEASUREMENT

the magnet needle *M*. The alternating primary flux in this case is opposed by an alternating secondary flux in phase and synchronism with the former. But now we know that the alternating-current current transformer approximates very closely to a magnetic flux balance, the only difference being that the secondary current is not furnished from a separate source, but the energy flowing through the secondary circuit is derived from the primary circuit. If we assume that the energy required to send the secondary current through the circuit is so small as to be negligible, a true magnetic current balance will be obtained. For commercial measurements, using low secondary loads, the ratio of such a transformer is practically a fixed one. The advantage of the alternating-current current transformer as an automatic flux balance over the mechanical automatic flux balance is in its greater simplicity and therefore reliability, and if we assume the resistance of the secondary circuit of a current transformer constant over a comparatively short period of time, we can apply the proportioning method described before with a high degree of accuracy by using a current transformer suitably wound for a large number of ratios.

The knowledge of this simple truth has resulted in the development of a very convenient calibrating apparatus (see Fig. 3), and method for alternating current, which in many respects can be compared with the potentiometer method for direct current. With the potentiometer, after balancing by means of the galvanometer a known standard emf. value against the voltage drop of a current flowing through a resistance, we are enabled to balance larger or smaller emfs. against the drop of the same current in larger or smaller sections of the resistance. With the magnetic current balance, after balancing by means of the auxiliary secondary instrument a known primary current flowing through a given number of turns, we are enabled to balance larger or smaller primary currents flowing through smaller or larger number of turns against the same current flowing in the secondary.

Proper multiple-ratio transformers have been built, covering a range of amperes from 0.25 to 5 and from 10 to 200, which will take care of practically the whole field of calibrating commercial ammeters. These transformers have sufficient intersections whereby it is possible to obtain every current value in the limits specified which may be required to calibrate the ten or fifteen calibration points of all ammeters falling within the range of the transformer. For instance, a 150-amp. ammeter can be calibrated on fifteen points of its scale, or a 10-amp. ammeter on its ten calibration points, etc. To make it possible to apply the above principle to proportioning currents in as great a number of current values as possible without making the mechanical construction too complicated, a number of special features enter into the make-up of the apparatus, which are briefly as follows:

INCREASING THE CURRENT RANGE

Arrangements are made so that each primary winding section can be used for different current values ranging from 10 per cent to 100 per cent of its rated capacity. To make this possible, sections in the secondary winding are provided for 10 per cent to 100 per cent of its total turns. The same secondary meter will thus balance current values ranging from 10 per cent to 100 per cent of the normal rating of each range. For instance, if we take a 5-amp. value as known and indicated by standard *S* (Fig. 5), and assume the lever *L* set on the 5-amp. range, the 5-amp. current from the source *B* will be transformed in the transformer *T* to, say, 5 amp., as indicated by the auxiliary secondary meter *A*. This current, as read on auxiliary meter *A*, will balance correctly a multiple value of 5 amp. according to the rating of the different primary ranges. If, for instance, we want to calibrate the meter *A* of, say, 200 amp. capacity, we short-circuit the standard *S* and raise the primary current step for step to the current values required for calibrating the meter *A*; that is, 20, 40, 60, 80, 100, 120 and so on, and with each raise move the lever *L* to the corresponding current range—20, 40, 60, 80, 100, 120, etc.—and maintain for each step the same magnetic balance as was indicated by the meter *A* when 5 amp. was flowing through the 5-amp. primary winding. With the proper balance each of the ampere values will be as correct as the 5-amp. value used as standard value. If we want to calibrate a smaller capacity meter, say 20 amp., we have to give the same ranges used before, one-tenth the value, which is done by sending the standard current of 5 amp. through the 50-amp. range and connecting the secondary meter to the 10 per cent tap. The 20, 40, 60, 80 ranges will then be of 2, 4, 6, 8, etc., amp. capacity. It can

easily be seen that in this way any ammeter in the prescribed limits can be calibrated accurately and with great speed and with only one current value, say 5 amp., known.

In order to establish the same magnetic balance for all ranges with current values reciprocal to the number of turns of the ranges, it is necessary to keep the leakage reactance of the secondary for a given ampere-turn value the same for all ranges. Two methods have been pursued to obtain this end. One was by using a ring core with all ranges wound concentric thereon and concentric to the secondary. Another way, more practical from a manufacturing standpoint, was to interlace the winding in such a manner that the magnetic center of effect for each section is on the same point. It is then possible to use any standard core construction and form-wound coils. In order to make use of one ampere-turn value for the calibration of any one ammeter or wattmeter, ampere-hour meter or watt-hour meter—in other words, to get along with only one standard reference value of current or wattage for such work and thus maintain magnetic balance by means of only one secondary current value—it would be necessary theoretically to find an ampere-turn value which is evenly divisible by every one of the figures from 1 to 15 inclusive. Such a value is many times too large to be practicable for current-transformer design, and therefore the problem had to be solved to produce the same results with a small number of ampere-turns, say 1,000 or 2,000. Three different methods have been pursued to obtain this end.

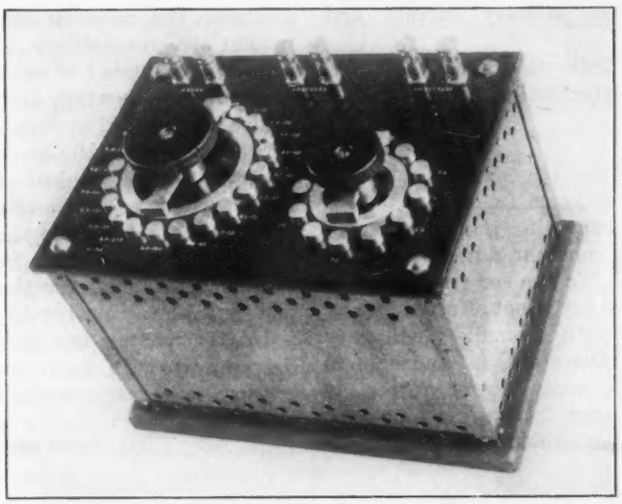


FIG. 3—CONVENIENT ARRANGEMENT OF CURRENT BALANCE

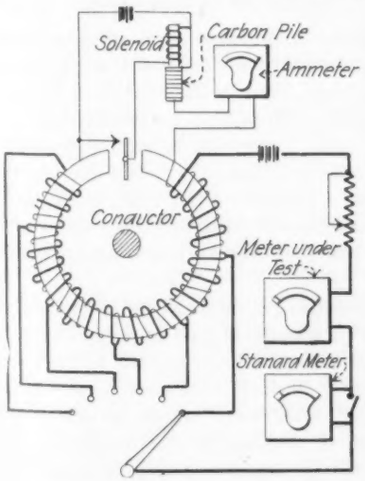


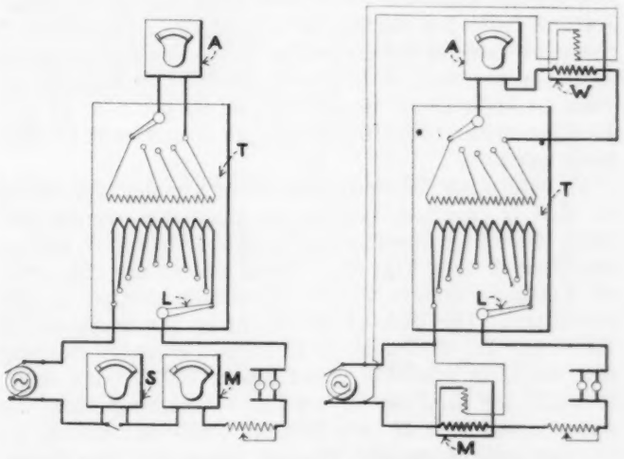
FIG. 4—SEVERAL RATIOS ARE READILY OBTAINED

One was by providing three special calibrating taps which made it possible to obtain from the original standard 5-amp. value two other standard ampere values, so that for the calibration of every 100 or 150 division instrument three ampere-turn values were used. Most suitable for this purpose were found the values 1,760, 1,800 and 1,820, as there is no value from 1 to 15 which is not divisible into one of the three figures. This method works out well. The calibrating ranges of the transformer are distinguished by colors, red, white and black in three groups. The 10-20-30-40-50-60-90-100-120-150-180-200-amp. range falls in the 1,800 group; the 80-110-160 falls in the 1,760 group, and the 70-130-140 falls in the 1,820 group. The only disadvantage is that for the complete calibration of almost every instrument reference has to be made to three readings. To cut this down to one, a second method was used by employing instruments in the secondary which have three ranges, so that for the 1,760, 1,800 and 1,820 ampere-turn group, and with the respective instrument range cut in, the same readings would secure the proper balance. This second method worked out well for wattmeter calibration where it was easily possible to provide three ranges by means of a potential resistance. For ammeters it was more difficult, but assuming that a satisfactory ammeter could be built the above method would still have the disadvantage that special auxiliary instruments have to be provided. This disadvantage was finally overcome by using a third and most satisfactory method; namely, that of ratio correction.

As has been pointed out above, the 1,800-ampere-turn group embraces all but six ranges; therefore, it is only necessary to alter the current flow in six of the odd primary ranges slightly more than 1 per cent or 2 per cent for the 1,760 and 1820-ampere-turn groups, respectively, to bring the ampere-turn values all up to 1,800, with the result that only one reference reading is required and no distinction has to be made between the ranges and no special auxiliary instruments have to be employed.

APPLICATION TO WATTMETER CALIBRATION

Primarily the magnetic current balance is intended for current calibrating work, for which a very high degree of accuracy is attainable; but its application can also be extended to the work of calibrating wattages with very good accuracy. Assuming that we apply to the meter under test, the standard meter and the auxiliary meter the same potential in a fixed phase relation to the current, we will proportion our wattages in the



FIGS. 5 AND 6—CONNECTIONS FOR AMMETER AND WATT-HOUR-METER CALIBRATION

same ratio as the currents; but if the phase relations vary during our test, the accuracy of the test will suffer.

To what extent this affects us will be shown in the following:

Assume: I = primary current,
E = potential,
i = secondary current,
ρ = angle between primary current and potential,
α = phase angle between I and i,
r = current transformation ratio,
C = coefficient.

Then:

$$IE \cos \rho = CriE \cos (\rho - \alpha).$$

As $ri = I$, we get: $C = \cos \rho / \cos (\rho - \alpha)$.

Our test accuracy will vary in the same proportion as C varies. If C is constant during test, the accuracy will be 100 per cent. We can see from the formula that with $\alpha = O$ our accuracy is not affected by any changes in the angle ρ, and with α small C will vary very little if ρ is small. It, therefore, is advisable to work as near as possible to unity power factor, if variation in ρ cannot be avoided. If we assume ρ to vary between 2 deg. and 5 deg. and the angle α to be 30 min., C will vary:

$$\frac{\cos 2^\circ}{\cos 1.5^\circ} - \frac{\cos 5^\circ}{\cos 4.5^\circ} = \frac{0.9994}{0.9997} - \frac{0.9962}{0.9969} = 0.0004,$$

or approximately 0.04 per cent.

The error, as can be seen, is thus reduced to an amount negligible for ordinary calibrating work. To make this variation of ρ extremely small and thus cut out every possible error, a small transformer can be provided to furnish the testing current with numerous secondary voltage taps, corresponding to the current ranges of the magnetic current balance. With voltages varying reciprocally to the current values held, the power factor will automatically stay constant.

RAPID TESTING OF WATT-HOUR METERS

To determine the characteristic of watt-hour meters under various conditions of voltage, power factor, temperature, etc., the magnetic current balance is of great help. Heretofore such work has been very tedious and the results obtained have been more or less unsatisfactory from the standpoint of accuracy. In most of these tests we are not interested in the absolute accuracy of the meter, but in relative performance; that is, we want to know if on 10 per cent or 50 per cent of full load the meter runs 10 per cent or 50 per cent of full-load speed.

To determine the characteristic of a meter, therefore, all that is required, besides the magnetic current balance, is another uncalibrated watt-hour meter W and an ammeter A (see Fig. 6). These meters are connected as auxiliary meters across a suitable section of the secondary. The disk of the auxiliary meter should be scaled for 100 divisions, or if a small capacity rotating test meter is available which has a 100-division scale, it could be used to advantage. Assuming that the meter under test M is a 50-amp. watt-hour meter, we set the lever L on the 50-amp. range and the 5-amp. auxiliary meter across the full 5-amp. secondary winding. A common potential is applied to the meter under test and to the auxiliary meter. If we now pass a current through the meter under test so that, say, 5 amp. is read on the ammeter, we shall have very close to full-load current on our meter M, and if we then start both watt-hour meters simultaneously and stop them simultaneously after the meter M completes, say, ten revolutions, we obtain a certain speed ratio which, for convenience of calculation, can be made close to 1 by shifting the magnet on the auxiliary meter until the meters run at approximately the same speed.

With a primary lever setting of, say, 5, 10, 20, 30, 40, 50, and the current held roughly constant on the ammeter, the meter M should complete 1, 2, 4, 6, 8, 10 revolutions, respectively, for the auxiliary's ten revolutions. The number of revolutions made by the auxiliary meter for each setting divided by ten represents numerically the correction factor of the meter under test M for the loads of 10, 20, 40, 60, 80 and 100 per cent relative to the full-load point. For instance, if the auxiliary meter when stopped had completed 10.055 revolutions and the run was made with lever setting for 20 amp., the correction factor of the meter on 40 per cent load is 1.0055, or the meter is very close to 0.55 per cent slow relative to the full-load point.

In this manner the characteristic of a meter can be determined with extreme accuracy by one observer, without accurate standards, without perfectly steady current, without timing devices, and without calculations, in a remarkably short period of time, giving the meter under test little chance to change its characteristics during the test owing to varying room temperature, self-heating or frictional changes. The characteristics can be determined for overloads by choosing lever settings above 50, say 100, 150 and 200 amp., corresponding to 200, 300 and 400 per cent load. To determine the characteristic at a different frequency, wave shape or temperature, all that is necessary is to maintain during the test the same voltage, power factor, frequency, wave shape or temperature. If it is further desired to know how the different characteristic curves are located relative to each other, it is only necessary to determine with a 5-amp. standard, cut into the primary circuit for the lever setting 5 amp., the absolute record of the auxiliary meter with 5 amp. flowing through it at the beginning or the end of each run for the different voltages, power factors, etc.

CALIBRATING CURRENT TRANSFORMERS

In order to determine the ratio and phase-angle errors of current transformers of different capacities, it is customary to compare them with standard transformers of the same ratio. Here the magnetic current balance furnishes a very convenient multiple-ratio standard, doing away with a large and expensive set of calibrated transformers. Further than that, it is self-checking; we can standardize it by using its one-to-one range and comparing the primary directly against the secondary current.

This method of establishing a current ratio standard is an absolute method and was developed and used by the writer in 1912 and first described by him in his article in the ELECTRICAL WORLD, Vol. 67, page 92.† A "two-watt-hour-meter method" was used, which is described in the same article and is similar to the method independently developed by P. G. Agnew, associate physicist Bureau of Standards, and published in Scientific Paper No. 233. In later years numerous improvements have been made in the application of this simple and useful method of establishing a standard by the development of a differential watt-hour meter and other modifications, the description of which will be left to a later article.

†A similar method was described by H. M. Crothers in the ELECTRICAL WORLD, Feb. 7, 1920.

Self-Interest a Key to Utility Financing

Manufacturers, Dealers, Contractors, Jobbers, the Public and Employees Should All Be Brought to Realize What Central-Station Expansion Means to Them—What California Has Done and Hopes to Do Along This Line

By A. EMORY WISHON
Assistant General Manager San Joaquin Light & Power Corporation, Fresno, Cal.

HOW ARE the public utilities of the United States to be financed? How are the American people to be impressed with the necessity for supplying and safeguarding the billions of dollars required to develop further the great electrical industry? These are two problems every utility management is endeavoring to solve. A comparatively simple solution offers itself.

First, the entire electrical industry—central station, manufacturer, jobber and contractor-dealer—must be infused with the electrical idea; second, the electrical industry itself must bring about a general public understanding of what electrical development is doing for the nation and what it means in dollars and cents to every individual in the nation.

Before a sympathetic response can be expected from the public the industry itself must be prepared to stand inspection. This done, there is nothing to fear from public scrutiny. Before the industry as a whole can make the expansion required of it its different branches must shoulder their respective responsibilities and do for the industry as much from the inside as they expect the public to do from the outside.

A. EMORY WISHON

An idea of how vital and far-reaching this responsibility is can be gained by reviewing what electrical development means in only one section of the nation, the Far West. California power companies will require $332,000,000 of new capital in the next eight years if they are to meet the public demand for more electricity. The capital now invested in electric plants in California is $158,480,000, with an installed steam and hydro-electric rating of 792,400 kw. The estimated hydro-electric resources of the State are 7,818,000 hp. maximum. The present installed steam and hydro-electric capacity of ten states west of the Rocky Mountains is 1,664,267 kw. The water-power resources of this section would generate 30,000,000,000 kw.-hr. annually. Therefore, on the basis of California's requirements, it may be conservatively estimated that the Far West will need $30,000,000,000 of new money if colonization, irrigation, mining and manufacturing in this great territory are to be extended.

The development of the West is entirely dependent upon the development of its hydro-electric resources. This is a territory equal to 40 per cent of the nation's area. It contains only 8 per cent of the nation's population, but it is consuming 20 per cent of the nation's output of electrical energy. The per capita use of the Westerner is more than three times that of the Easterner, the average cost of a kilowatt-hour in the West being about one-half that in the East. This demand is rapidly increasing and is so far ahead of the available supply that Western power companies are rushing construction on 190,825 kw. of additional capacity for 1920.

This increasing demand is based upon an unparalleled prosperity. The chief industries are agriculture, mining and lumbering. The exports are mostly raw products, bringing large financial returns and ability to purchase the manufactured articles of the East. The West produces 35 per cent of the nation's petroleum, 85 per cent of the copper, 91 per cent of the gold and 96 per cent of the silver; agriculturally it produces 17 per cent of the wheat, 15 per cent of the cattle, 25 per cent of the orchard fruit and 47 per cent of the nuts. It contains the largest reserves of standing timber and has built up a flourishing shipbuilding industry. Electricity is virtually the only power used in the mines, in pumping for irrigation, in fruit packing, sugar refineries and shipbuilding. Furthermore, 90 per cent of the Western homes are wired for electricity, and there is a widespread use of electric labor-saving devices—past sales being $30 per capita as compared with $7 in the East.

The "Near West"—the Pan-Pacific area—is also looking to the United States for most of its electrical equipment and offers a rich field for the American manufacturer. Whereas the Atlantic is bordered by countries inhabited by 325,000,000 people, the countries bordering the Pacific contain 630,000,000. The Pacific area contains nearly half the globe, and its possibilities for electrical merchandising are enormous.

Central-Station Development the Fundamental Need

Central-station development is the thermometer that indicates the degree of prosperity of the entire electrical industry. While it is true that manufacturers and dealers in many lines of appliances have more business in prospect than can be cared for, nevertheless they are

rapidly approaching a point of temporary saturation. Business men with a turn for analysis in electrical merchandising and manufacturing circles are beginning to take stock of the merchandising possibilities of the future. Throughout the eastern section of the nation there is a woeful lack of wired houses. In all sections of the nation there is a woeful lack of wiring standards, outlets and other facilities, this lack preventing the sale and use of appliances after they have been offered to the trade. Furthermore, it is beginning to appear that intensive competition in some lines, particularly washing machines, is rapidly bringing the point of temporary saturation very much closer than the casual observer realizes. More discouraging than all is the general shortage of central-station power. At the rate electrical equipment and appliances are now being manufactured it will be several years before there will be sufficient power available to put them all into use. In some sections of the nation—California for instance—there is an actual ban upon the purchase of all equipment and appliances that require additional installations of central-power distribution capacity, the only exception being in cases of vitally essential industries. This is because the California power companies have no power to sell. Un'ess more power is immediately developed more appliances cannot be sold and all the present activity for better merchandising methods and more energetic sales efforts will have gone for nothing.

Therefore it behooves the entire electrical industry to take the broader view of the situation. At present three branches of the industry—manufacturer, jobber and contractor-dealer—are riding on the crest of the wage of flourishing business. One hears on every hand of manufacturers bidding for more capital to increase their plants. But what is the use of this expansion if the prime movers of the industry—the central stations—do not grow in proportion? What is the use of larger factories and more stores filled with newer merchandise if the central stations cannot produce the electricity required to keep the new plants busy?

WHY THE CENTRAL STATION IS FALLING BEHIND THE OTHER GROUPS

The reason the central stations are not keeping pace with the other branches of the industry is that they are handicapped in their ability to finance new developments. The steadily mounting costs of operation, without adequate increase in rates to offset the loss in net earnings, has reduced the ability of the central stations to issue securities and has likewise reduced the public demand for these securities.

To finance electrical development a protected investment and a fair rate of return for capital are necessary. To provide this safeguard for investors legislative measures, both national and local, are essential. But before this can be brought about in most localities the people as a whole must be convinced that further electrical development is going to make more business and more prosperity for them—in a word, that it is to their self-interest.

Demagogues and cheap politicians have always held "open season" on public utilities. The utilities generally, for one reason or another, have considered it an improper policy to fight back. However, those who have had the courage to fight back and the facts behind them have always succeeded in making this sort of business very poor sport for public agitators. The great American public can be depended upon always to be fair. The utility that is clean and just in its dealings has nothing to fear from taking the public into its confidence. The company that will not sell stock to its consumers, its employees and the public in general, because of a desire to preserve the usual calm of the annual stockholders' meeting, is falling behind in the race. The public and the employee have the right to purchase ownership in their public utility. The utility should be concerned in giving the maximum of efficiency in service to the public with adequately paid and courteous employees. As a matter of fact, public utility employees should be the most efficient and the best paid of any class of employees coming in contact with the public.

CALIFORNIA COMMISSION SAYS RATES MUST BE INCREASED TO ATTRACT CAPITAL

When a utility is worthy of the respect of its public, there usually is little difficulty in commanding it. In this connection the wording of a recent decision of the Railroad Commission of the State of California, which exercises regulation and jurisdiction over all California utilities, in granting an increase in rates to a central-station company, is interesting:

"The money necessary to develop the power plants of the applicant is costing it in excess of 7 per cent per annum, and in the present case, where applicant is expending during the years 1919 and 1920 in excess of 50 per cent of the capital previously invested, it is very apparent that applicant's consumers cannot and should not expect to receive service at rates which will not make possible payment by applicant of the cost of money and something additional as compensation for the effort exerted to serve the public.

"It is well to emphasize in connection with the matter of increase in rates for electric service that even with the increase herein authorized the percentage of increase in the cost of electric service over pre-war conditions will be materially lower than the general increase in the cost of labor and supplies which applicant has had to pay, and is less in general than the increase in the price received by applicant's consumers for their products, whether the same be labor, manufactured products or products of the farm. Applicant's agricultural consumers are, in general, receiving prices for their products approximately 100 per cent in excess of those received prior to the war, and the prices of labor and supplies have also increased from 50 to 100 per cent.

"I feel certain that applicant's consumers will gladly meet their responsibility by paying the increased rates when they realize that it is vitally essential to the prosperity of the valley that the San Joaquin Light & Power Corporation be granted an increase in rates in order that it may continue to serve its patrons adequately and meet the increasing demands for power which are continually being made upon its system."

The California commission could well have gone further. It could have pointed out to the other branches of the electrical industry their responsibility to the central station in interesting themselves in the present-day central-station financial problem. A regulated and protected central-station security is the highest type of investment obtainable. It offers an opportunity for the three other branches of the industry to invest in a way that will bring a safe and satisfactory return and also cause greater results in the enlargement of the business horizon, to the benefit of all lines of industry and activity in the entire community.

Gaining More Speed in the Laying of Conduit

Use of Concrete Spacers Between Layers of Ducts Eliminates Need of Pouring Cement on One Layer of Ducts at a Time

BY T. C. RUHLING

IN CONSTRUCTING 15 miles (24 km.) of underground transmission line from its Northeast power plant to three substations, the Kansas City (Mo.) Light & Power Company worked out some ideas that saved time in laying duct lines. The lines consist of eight-duct runs of 4.5-in. (120-mm.) fiber conduit laid two ducts wide and four ducts high, with at least a 3-in. (75-mm.) separation of concrete, and 3 in. of concrete over all. At entrances to manholes the ducts are fanned out to spacings of 18 in. (457 mm.) between centers in width and 12 in. (304 mm.) between centers in height. Each duct line contains a 13,200-volt mineral-base cable capable of carrying from 5000 kw. to 6000 kw., making the maximum power per duct run about 48,000 kw.

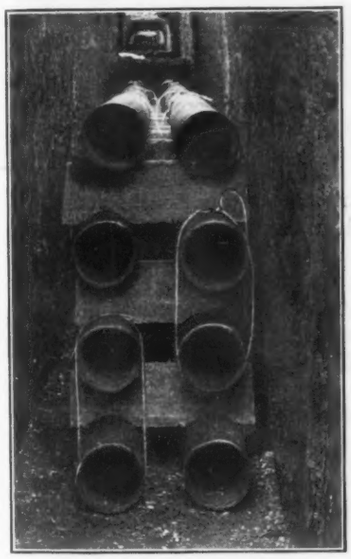


FIG. 1 — STANDARD 3-IN. SEPARATORS IN PLACE

It was desirable to pour the concrete for the entire run at one time, but there was objection to the use of wooden spacers between ducts because they are likely to absorb moisture and swell, which may crack the concrete, and because they do not have the same high value as separators which is given by concrete. The idea of manufacturing concrete separators was advanced and worked out successfully.

Several types of concrete separators have been used, some grooved to fit the fiber ducts and some simply square concrete blocks. They were all made by a crew of four men using wooden molds. This crew in a nine-hour working day would make about 400 separators. The concrete was a one-to-three mixture of Portland cement and clean sharp sand. For convenience and to save labor the separators were made at the underground material storage yard.

In laying the conduit with this scheme a 3-in. (75-mm.) base of concrete was laid comparatively dry in the bottom of the trench. Upon this the entire duct structure was built up with the concrete separators between the layers of ducts, as shown in Fig. 1. Hemp twine was used to tie the layers of conduit together and to tie the whole duct structure down so that it would not be floated when the concrete was dumped into the trench from wheelbarrows. After the conduit was built up and tied it was possible to move it about the trench to insure more perfect alignment. A straight spade or hoe with an extended blade 18 in. (45 cm.) long was used to get the concrete between the lower ducts, since any voids would reduce the protection to the ducts. While none of this trouble occurred at Kansas City, the possibility of it should be realized and guarded against. At Kansas City the conduit was covered with a 12-in. (30 cm.) plank where concrete was thrown on top of a duct in order to prevent breakage.

Special separators were used for supporting the ducts where the process of fanning out to approach a manhole was necessary. The spreading begins 25 ft. (7.5 m.) from the manhole. Graded separators placed every 5 ft. (1.5 m.) gradually increase the distance between ducts. Such a graded line set up on top of the ground where it could be easily photographed is shown in Fig. 2.

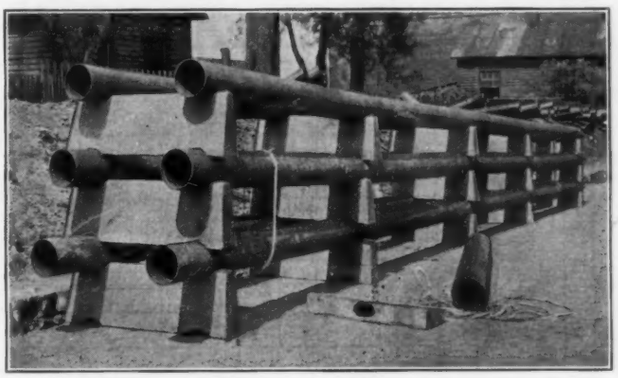


FIG. 2—GRADED SEPARATORS FOR APPROACHING MANHOLE

In addition to these grooved separators the company has also developed square separators such as are shown in Fig. 3. These are less expensive to make than are the grooved separators. Moreover, it is found that less hemp twine is required to tie the conduit in place when square separators are used. The picture showing the square separators in use was taken where special construction prevails. However, they may also be used on straight duct runs four ducts high and two ducts wide. In such places it is the practice to use short separators between the horizontal layers of ducts and long separators vertically between the two tiers of ducts. The conduits are then tied to the separators.

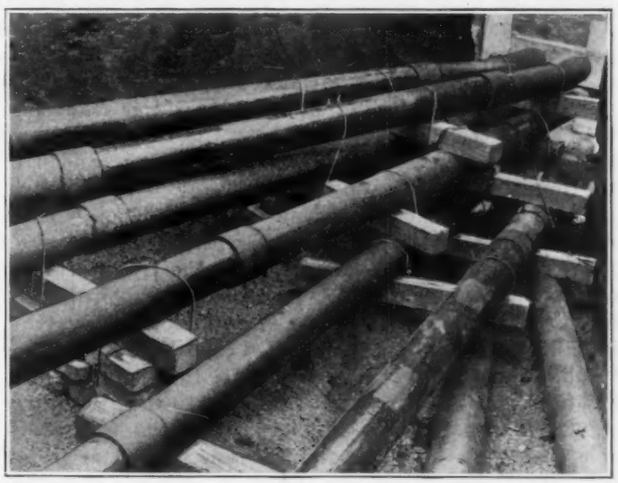
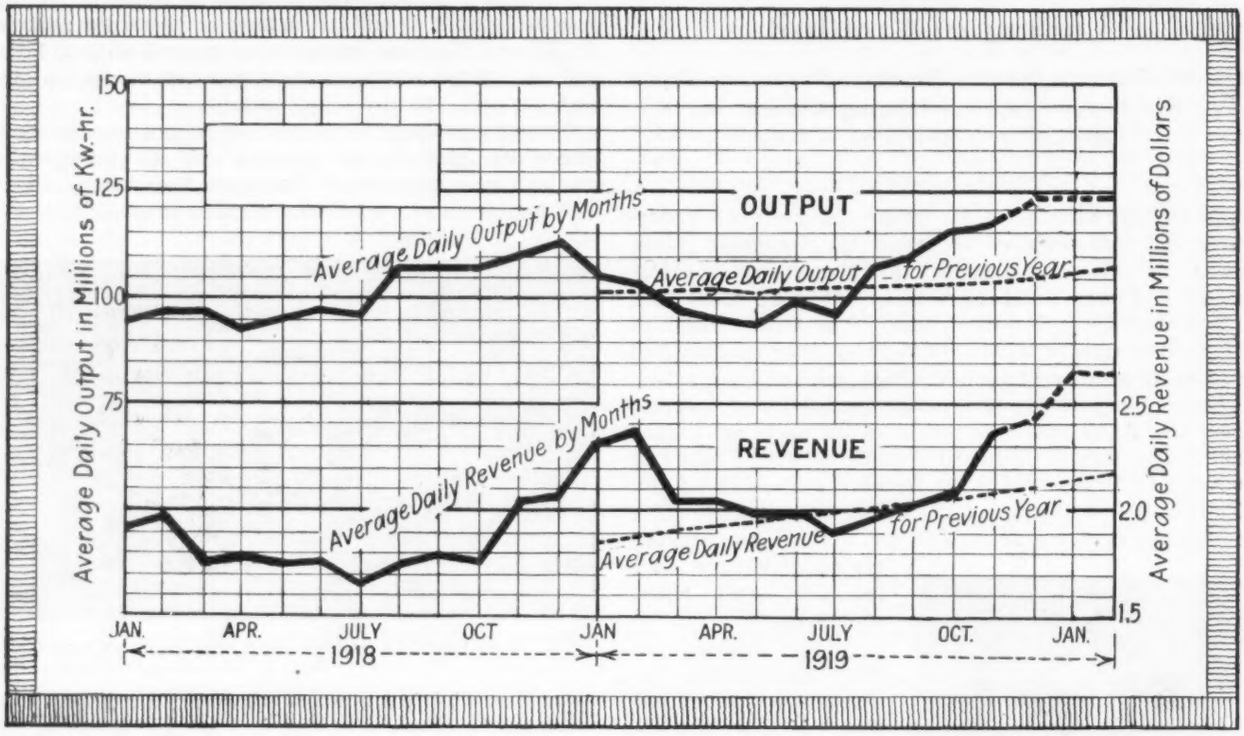


FIG. 3—SQUARE SEPARATORS ARE LESS EXPENSIVE

For a description of the manholes on the system see the ELECTRICAL WORLD for Feb. 22, 1919.

Adverse Conditions Fail to Lower Output



THE recent large growth in the utilization of electrical energy in American industry is clearly accentuated by the central-station returns received by the ELECTRICAL WORLD for the month of February. Severe weather conditions, unusual car shortage and seasonal variation in illumination requirements were factors tending to lower the output materially, but despite these three adverse conditions the daily output for February was 123,200,000 kw.-hr. against 123,500,000 kw.-hr. for January. The period during which the output of the central stations of the country can be estimated by the seasonal requirements for illumination is past, and it is evident that as electrical energy permeates the industrial world the relative importance of the illuminating branch of the industry will steadily decline.

During February the New England States experienced snow and ice conditions without parallel since 1857, resulting in a severe tie-up in the transportation of fuel and raw materials. Many factories were forced to suspend operation for lack of raw material or from inability to ship manufactured goods. But labor troubles were unusually conspicuous for their absence, and as a result the factories were able to work at nearly maximum capacity when the raw material was available, resulting in a demand for electrical energy for the month exceeding any previous record. The increased output for this section over February of last year was 27.5 per cent.

Similar power demands were exhibited in the Atlantic States. The production of pig iron was at the rate of 37,850,000 gross tons per year, representing a plant capacity of 84 per cent, and the output of steel ingots was over 44,000,000 tons per year, representing an 83 per cent capacity. This production and consequent enormous demand for electrical energy prevailed in the Birmingham district as well as in the iron regions of the Middle Atlantic States. More than 200 textile mills are under construction in the Southern States, 90 per cent of which will probably use electrical power. Demands for electrical energy by textile mills are increasing monthly, especially in North Carolina. Textile mills in Gaston County of that State contain 1,012,696 spindles, which is exceeded only by Bristol and Middlesex Counties in Massachusetts and Providence County in Rhode Island.

The Central States present a condition which is especially indicative of the increasingly large demand for electrical energy by manufacturing industries. The gain of this section as a whole over February of last year was 29.8 per cent. A close study of the returns, however, indicates that the South Central States, which are not essentially manufacturing communities, showed an increase of only about 12 per cent over February of 1919, while the energy demands of the North Central industrial States were from 33 to 36 per cent in excess of February, 1919.

The Mountain and Pacific States again emphasize the

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Capacities Represented	Revenue from the Sale of Energy			Percentage of Installed Capacities Represented	Kw.-Hr. Output		
		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
Mar.	45	$28,579	$24,447	17.3	45	1,359,296	1,340,210	1.0
Apr.	45	27,740	23,919	16.0	45	1,279,274	1,240,782	2.9
May	45	27,795	24,291	15.5	45	1,306,622	1,314,206	—1.0
June	47	28,175	24,701	14.1	47	1,399,951	1,367,908	2.3
July	44	25,794	22,568	14.1	44	1,309,301	1,281,874	2.0
Aug.	54	32,756	29,006	13.0	54	1,801,836	1,793,706	0.5
Sept.	53	32,344	28,336	14.0	53	1,761,582	1,695,862	4.3
Oct.	55	35,492	30,077	18.0	60	2,175,636	1,987,004	9.0
Nov.	53	37,439	31,927	17.2	58	2,055,428▼	1,895,693	8.2
Dec.	59	44,125	37,978	16.0	65	2,509,571▲	2,270,833	10.0
		1920	1919			1920	1919	
Jan.	54	44,531	37,169	20.0	64	2,450,924	2,078,880	18.0
Feb.	*57	43,835	36,020	22.8	67	2,395,065	1,920,428	24.1

*Includes estimates for twenty-five companies, representing 6.2 per cent of the total installed capacity of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				Central States				Pacific and Mountain States			
		Percentage of Installed Capacities Represented.	1919	1918	Per Cent Increase.	Percentage of Installed Capacities Represented.	1919	1918	Per Cent Increase.	Percentage of Installed Capacities Represented.	1919	1918	Per Cent Increase.	Percentage of Installed Capacities Represented.	1919	1918	Per Cent Increase.
REVENUE	Mar.	71	$3,561,000	$3,020,000	17.9	44	$11,809,000	$10,312,000	14.5	36	$8,991,000	$7,430,000	20.9	54	$4,218,000	$3,685,000	14.1
	Apr.	71	3,468,000	2,942,000	17.8	43	11,516,000	10,213,000	12.3	36	8,427,000	7,009,000	20.3	56	4,329,000	3,755,000	16.5
	May	70	3,190,000	2,781,000	14.9	43	10,817,000	9,826,000	10.1	36	8,320,000	6,910,000	20.5	56	5,468,000	4,764,000	14.2
	June	71	3,317,000	2,904,000	14.1	43	10,605,000	9,537,000	12.0	38	8,757,000	7,504,000	16.2	63	5,496,000	4,767,000	15.2
	July	70	3,406,000	2,995,000	13.7	40	9,320,000	8,375,000	12.0	38	8,854,000	7,442,000	19.0	49	4,214,000	3,756,000	12.1
	Aug.	74	4,225,000	3,693,000	14.4	57	12,174,000	10,995,000	11.1	45	10,942,000	9,309,000	17.1	61	5,415,000	5,009,000	8.5
	Sept.	73	4,019,000	3,536,000	13.6	53	11,429,000	10,069,000	13.5	44	11,395,000	9,766,000	16.2	63	5,501,000	4,965,000	10.9
	Oct.	72	4,127,000	3,453,000	19.1	53	12,684,000	10,822,000	16.9	50	13,241,000	11,003,000	20.1	62	5,440,000	4,799,000	13.9
	Nov.	71	4,432,000	3,800,000	16.2	56	14,738,000	12,761,000	15.7	44	12,604,000	10,383,000	22.1	63	5,665,000	4,983,000	13.9
	Dec.	73	4,908,000	4,254,000	15.1	57	15,926,000	13,806,000	15.8	51	14,156,000	11,903,000	18.5	77	9,135,000	8,015,000	14.2
			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	77	5,605,000	4,695,000	19.4	57	16,237,000	13,373,000	22.0	52	15,301,000	12,779,000	20.0	75	7,388,000	6,322,000	16.1
	Feb.	82	5,219,000	4,344,000	20.5	58	15,779,000	13,151,000	11.7	54	15,705,000	12,504,000	25.8	78	7,132,000	6,021,000	18.6
			1919	1918			1919	1918			1919	1918			1919	1918	
KW.-HR. OUTPUT	Mar.	71	125,411,000	122,541,000	2.3	44	461,567,000	462,972,000	−0.1	36	441,604,000	422,928,000	4.1	54	330,714,000	331,769,000	−0.3
	Apr.	71	123,111,000	116,411,000	5.7	43	431,572,000	424,049,000	2.0	36	382,779,000	358,858,000	6.9	56	341,812,000	341,464,000	0.1
	May	70	120,856,000	120,908,000	−0.1	43	413,043,000	430,729,000	−3.9	36	390,667,000	377,525,000	3.6	56	382,056,000	385,054,000	−0.9
	June	71	127,260,000	119,217,000	6.7	43	408,335,000	419,060,000	−2.5	38	418,542,000	386,422,000	8.0	63	445,814,000	443,209,000	0.5
	July	70	141,551,000	130,393,000	8.2	40	373,105,000	378,053,000	−1.5	38	428,370,000	408,165,000	5.3	49	366,275,000	365,263,000	0.1
	Aug.	74	161,431,000	153,266,000	5.1	57	640,616,000	662,120,000	−3.2	45	555,763,000	513,591,000	8.1	61	444,026,000	464,729,000	−4.2
	Sept.	73	153,837,000	146,209,000	4.5	53	610,254,000	610,179,000	0.1	44	573,835,000	518,767,000	11.0	63	423,656,000	420,707,000	0.5
	Oct.	72	162,859,000	142,326,000	14.4	53	694,584,000	659,859,000	5.3	62	882,439,000	766,407,000	15.2	62	435,754,000	418,412,000	4.1
	Nov.	71	153,171,000	140,240,000	9.2	56	724,607,000	707,347,000	2.4	56	754,838,000	657,362,000	14.8	63	422,812,000	390,744,000	8.2
	Dec.	73	180,493,000	152,304,000	18.0	58	803,165,000	733,222,000	8.9	65	913,971,000	787,687,000	16.1	77	611,942,000	597,620,000	2.5
			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	77	206,290,000	159,199,000	29.8	58	776,286,000	656,879,000	18.2	66	930,044,000	802,581,000	16.0	75	538,304,000	460,221,000	16.2
	Feb.	82	186,685,000	147,659,000	27.5	58	738,677,000	618,890,000	18.0	68	963,246,000	743,719,000	29.8	78	506,457,000	460,160,000	23.4

increased importance of the industrial power demand. Activities in the copper regions were about the same as in January, and car shortage and unsettled labor conditions in the coast states affected business in all its aspects. Yet this section consumed 23.4 per cent more electrical energy than in February, 1919.

Need of Trained Electric Furnace Operators*

BY ACHESON SMITH
President Electric Furnace Association

THE weight of steel castings made in the electric furnace has increased from 9,207 gross tons in 1913 to 108,296 gross tons in 1918. The number of electric furnaces in operation has increased from 22 in 1913 to 363 in 1919. The crucible-steel industry is one of great magnitude and is of the highest importance, but in 1918 the production of electric steel exceeded the tonnage produced by the crucible process by nearly 400 per cent. Tables I and II show comparative outputs of steel ingots and castings made by the crucible and electric steel processes in the United States since 1913.

While a large number of electric furnaces were installed for war production during the years from 1914 to 1918 inclusive, compared with previous years, the operators of electric furnaces in the United States have been busy during 1919 and have operated at a very considerable percentage of their capacity. During 1919 there were at least thirty-three new electric furnaces sold for the production of steel and at least eighty-eight for the melting of brass, which indicates that the demand for products of the electric furnace was apparently exceeding the ability of manufacturers to supply them during last year.

The possibility of using the electric furnace in the production of brass and other non-ferrous metals has just begun to be appreciated, and it is only recently that a considerable number of electric furnaces have been used in this field. At the beginning of 1919 there were possibly fifty-eight electric furnaces producing brass, while at the beginning of 1920 there were at least 146 electric furnaces engaged in this work. The results already accomplished indicate that the application of the electric furnace in this field has been highly successful, and the demand for more furnaces will follow rapidly.

The manufacture of steel and brass in the electric furnace is not simply the application of electrically produced heat in place of heat generated by gas or other means. If this were so, it would simply be a question of which gave the lowest cost. The movement in favor of electrically produced metals is far more fundamental and is based primarily upon the high quality of the products made in the electric furnace. In many classes

*Abstract of a paper presented at the joint meeting of the A.I.E.E., American Electrochemical Society and Electric Furnace Association at Boston, Mass., April 8 to 10, 1920.

TABLE I—PRODUCTION OF STEEL INGOTS AND CASTINGS

Year	Crucible Process, Gross Tons	Electric Furnace, Gross Tons
1913	121,226	30,180
1914	89,869	24,009
1915	113,782	69,412
1916	129,692	168,918
1917	126,716	304,543
1918	115,112	511,364

TABLE II—PRODUCTION OF ALLOY STEELS, 1918

Process	Ingots, Gross Tons	Castings, Gross Tons	Total, Gross Tons
Open-hearth, basic	1,013,913	10,724	1,024,637
Open-hearth, acid	323,913	29,191	353,104
Bessemer convertor	41,286	23,430	64,716
Crucible steel	54,370	64	54,434
Electric steel	287,885	3,076	290,961
Total	1,721,367	66,485	1,787,852

of modern machinery, such as locomotives, tractors, trucks, automobiles, etc., great strains are brought upon various parts, due to road shocks and other conditions which develop during their operation. The demand for electric steel and electric brass is a result of the necessity for providing the highest possible quality of metals, in order to provide for such strains. Not only do the industries mentioned require a better grade of cast steel, forged steel and other ordinary steel parts, but they are requiring larger quantities of alloy steel, for the production of which the electric furnace is the ideal instrument where quality and uniformity must be considered.

During the war it was very difficult, and at times practically impossible, to find men to operate electric furnaces, as the furnaces were being installed more rapidly than men were being trained. After the signing of the armistice the demand for furnace operators was less acute. It was found, however, that while the supply seemed to be adequate, there was still a marked scarcity of desirable men. The trouble seems to have been that many men were drawn into this work who were not naturally fitted for it or not suitably trained, with the result that they either dropped out and took up other work or were set aside for better talent as soon as the higher-grade men could be procured. The result of this condition is that there is still a real need for competent men in practically all lines of electric furnace work.

The term "melter" is now used to designate the man in immediate charge of a furnace. "Metal superintendent" designates the man to whom the melter is responsible. He may have any title in the foundry or steel works, but his duties are primarily to operate successfully one or more electric furnaces. Such a man should have a thorough knowledge of the metallurgy involved, a complete understanding of the design of the furnace, an adequate knowledge of the electrical problems met by both the designer of the furnace and the supplier of power, and a practical understanding of the power service situation and how the operation of the furnace affects the power company. If the man has such comprehensive technical and practical knowledge of the ramifications of electric furnace work, he will so operate the furnace that he will not only get highly satisfactory results as to the quantity and quality of his output but will avoid mechanical and electrical disturbances which injure the operation of the furnace and disturb the power service by throwing undue load fluctuations on the line.

While the work of a "melter" is rough and at times arduous, it probably offers one of the best opportunities now open to young men who are not afraid of hard work. In addition to being highly remunerative, it is likely to lead to a position of greater responsibility, owing to the fact that the making of steel and other products of the electric furnace is in its infancy and will grow to very great proportions as the years go by. There is also probably no quicker way for a man to establish a reputation as a metallurgist than to engage in the production of metals in the electric furnace. Universities are providing technical courses to fit their graduates for electrical engineering and metallurgical work, and undoubtedly some of them are teaching the principles involved in the use of the electric furnace, but there seems to be a serious lack of practical training to fit men to fill positions with companies operating such furnaces.

Manufacturers' Enlarged Co-operative Effort

The Manufacturers' Council Is Developing an Organization to Afford Different Branches of the Industry a Point of Contact

WHEN the needs of the nation in war time made better organization and increased production imperative, the associations of the electrical manufacturing industry proved their immediate usefulness as a basis for enlarged co-operative effort. Now it is planned to apply the experience thus gained and to direct the organization of the industry so that it will yield advantageous results under peace conditions.

By their work in standardization and in the settlement of many problems touching the manufacturing industry as a whole, the electric manufacturing associations have well earned a place in the economic life of the industry. In general, the primary organization of the industry includes separate associations for the manufacturers of apparatus and of supplies, the Electric Power Club embracing manufacturers of apparatus and the Associated Manufacturers of Electrical Supplies embracing manufacturers of supplies. It was because no means existed for co-ordinating the work of these organizations and the oldest association of manufacturers, the Electrical Manufacturers' Club, that a further step was taken four years ago, when the Electrical Manufacturers' Council was formed then as a connecting link.

Although the Electrical Manufacturers' Council has been in existence, as just stated, for more than four years, the importance of its work has not heretofore been understood generally outside perhaps of the manufacturing part of the industry. While its work in the main is to co-ordinate the organizations of manufacturers in the industry, it also recognizes an obligation to the entire industry and in its policies and action it seeks to advance the interests of all.

As the result of an informal discussion of the fact that the existing organizations of manufacturers had no means of co-ordinating their work, a meeting of representatives of the three associations was held in New York on Feb. 7, 1916. It was decided to form a unifying council and formal organization was thereupon effected. At the second meeting a constitution and by-laws were adopted. Later, as the scope of the work was broadened, these were amended. Following are the objects of the council as now set forth in its constitution:

1. To recommend to the member organizations such policies as will in its judgment promote the welfare and interests of the electrical manufacturing industry.

2. To co-ordinate by all lawful and proper means the work of all member organizations.

3. To furnish to member organizations a clearing house for all questions of common interest which may be presented by any member organization, so that conflicting action may be avoided and concerted action taken where necessary.

4. To afford facilities for conferences between member organizations and other organizations, so that close co-operation may be secured.

5. To exercise such functions and undertake such work as it is specifically authorized to perform by favorable action upon the part of each member organization.

In carrying out the objects of its creation the council

has construed its functions broadly. The immediate opportunities for its work arise in the divergent lines of activity in the three associations. As those who are familiar with the electrical manufacturing industry know, the existing organizations have a total membership of from about 275 to 300 companies.

BROAD SCOPE OF COUNCIL'S WORK

A review of the proceedings of the council on several of the matters of general interest which have been brought before it indicates the broad scope of its work.

One of the first subjects suggested for consideration was that of uniform cost accounting. As a result of the work of a standing committee a system was developed which met the approval of Edward N. Hurley, then chairman of the Federal Trade Commission. This system is designed for use by either large or small companies, and it has been installed by many manufacturers. Revisions in the system to keep it up to date are made by the committee, whose work is continuous.

Another subject which is more indicative of the public-policy character of part of the work of the council was the action taken upon recommendation of a committee after consideration of the question of safety codes. The result of this was the formation of an Electrical Safety Conference, consisting of representatives from the Bureau of Standards, the National Workmen's Compensation Service Bureau, the Underwriters' Laboratories and the Electrical Manufacturers' Council.

Upon request of one of the constituent organizations of the council an extended study was made by a special committee for the purpose of effecting standardization of trade literature in the electrical manufacturing industry. The outcome of this study was the recommendation that standards be adopted of 8½ in. by 11 in., side binding, for all electrical catalogs, bulletins, data sheets, contract forms, letterheads and large price sheets, and of 4 in. by 7 in., side binding, for small price lists and data sheets accompanying them.

In the interest of the entire industry a committee was appointed by the council at the request of one of the member associations to give careful consideration to the subject of electric shows and exhibits. As a result the council is promulgating rules which it recommends to manufacturers as a guide in maintaining a high standard in such shows.

WAR SERVICE THAT WAS RENDERED

A plan for the organization of a general war service committee of the electrical manufacturing industry was adopted at a meeting called by the council on Nov. 2, 1917. The effectiveness of the organization during the war attracted much attention from government officials, who stated that the industry was better organized to assist in meeting the war requirements.

From the governmental contact thus formed there developed naturally other activities which under the different conditions of peace are still being conducted with a view to aiding both the governmental departments and the electrical manufacturing industry as a whole.

To further the transaction of its growing work the council decided recently to open an office in New York. Frederic Nicholas has been appointed executive secretary to carry out the policies of the council. It is the desire to enlarge the work in every possible way which will co-ordinate the existing associations of manufacturers and promote their useful development.

The members of the council are as follows:

Representing the Associated Manufacturers of Electrical Supplies—J. F. Kerlin, Corliss Carbon Company, Inc., Bradford, Pa.; W. T. Pringle, Pringle Electrical Manufacturing Company, Philadelphia; Warren Ripple, George Cutter Company, South Bend, Ind.; J. H. Trumbull, Trumbull Electric Manufacturing Company, Plainville, Conn.

Representing the Electrical Manufacturers' Club—D. R. Bullen, General Electric Company, Schenectady, N. Y.; LeRoy Clark, Safety Insulated Wire & Cable Company, New York; E. B. Hatch, Johns-Pratt Company, Hartford, Conn.; S. L. Nicholson, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Representing the Electric Power Club—J. C. Hobart, Triumph Electric Company, Cincinnati; C. L. Collens 2d, Reliance Electric & Engineering Company, Cleveland; E. R. Harding, Holtzer-Cabot Electric Company, Chicago; H. C. Petty, Crocker-Wheeler Company, Ampere.

VIEWS OF THE COUNCIL'S CHAIRMAN

S. L. Nicholson served as chairman of the council since the day of organization. In discussing its work Mr. Nicholson said:

"The main affiliations of the council are, of course, with the associations from representatives of which its membership is made up. It does, however, act as the co-ordinating body in reference to general matters affecting the relations of the Electrical Manufacturers with other organizations, those, for instance, with regulatory or engineering functions and those which may be classified as customer organizations. In other words, the council co-operates with the other associations on general matters and co-ordinates their activities. After the council has established the contact between different associations as a matter of general practice, specific questions or subjects, touching, for instance, the standardization of particular lines of products or conferences in reference to particular lines of products, are handled directly between the respective organizations or their sections, groups or committees and the committees of the other organizations. After the establishment of the initial contact, therefore, in many instances the work would not of necessity be sent to the council again. By maintaining constant contact with the various associations and the various governmental departments the council will, it is believed, render a service to them as well as to the manufacturers. There are many ways in which the different branches of the industry want to have contact with the manufacturers as a unit in order that results may be worked out which will promote the best interest of the industry as a whole.

"The Electrical Manufacturers' Council has done its work in the past without seeking any publicity. The work has now increased to such a point that it has become necessary to have a permanent office and to develop an organization to operate continuously, and this is being done by making the position of secretary an executive one instead of an honorary one as previously.

"A permanent office will be opened in New York in the near future, thus enabling the council to come into closer contact with other branches of the industry and thereby facilitating the work for the constituent organizations of the council. Heretofore there has been no single headquarters in New York for the electrical manufacturing industry as a whole. The great growth of the industry and the promising outlook for its future make it desirable now to have such an office with facilities for constructive upbuilding work."

Readers' Views and Comments

Need for Testing Rope Used by Linemen

To the Editor of the ELECTRICAL WORLD:

SIR: The Dayton Power & Light Company recently had an unfortunate experience in the use of ropes on 6,600-volt lines about which other central stations should be informed. The company has always endeavored to buy the best manila rope for use by its line department. Recently a coil of half-inch rope was purchased from the usual supply house and sent out on the line. One line crew were working over a 6,600-volt line, and as the groundman took hold of the lead line he was severely shocked and slightly burned. Another line crew shorted a 6,600-volt line before the rope was removed. In another case, when a street-lighting patrolman attempted to lower a street lamp, his hand line dragged over a railway feeder, severely shocking him.

All these cases occurred on two consecutive days, and samples of all ropes in supply and in use by the line crews were called in and given a high-tension test. The trouble was traced to a new coil. All of the rope from this coil broke down at from 500 to 7,000 volts per foot, while other samples withstood 36,000 volts per foot. The rope from the defective coil was immediately pulled out of service and on investigation was found to contain a small steel wire 0.007 in. in diameter. The wire was very difficult to find, but by fringing several inches of the rope and burning it off its presence was detected. The rope contained the usual marker, but the manufacturer claimed that by mistake the strand containing the steel wire, which is used as a marker for another style of rope, had been included in the coil.

This mistake, having happened at least once, may happen again. An order has therefore been issued that all rope purchased by the company, before being placed in stock, shall be subjected to a high-potential test.

F. A. KENTIG,
Dayton, Ohio. Dayton Power & Light Company.

Teachers Need Recognition More Than Salary

To the Editor of the ELECTRICAL WORLD:

SIR: The remarks which appeared in your issue for Jan. 31, page 269, under the title "Supporting Educational Institutions," are very interesting. Every one seems concerned about the question of financial support and the necessity of increasing the salaries of schoolteachers and college and university professors and instructors. It seems to the writer, however, that this is particularly important in the case of the schoolteachers; in the case of colleges and universities he is inclined to believe that the problem was before the war and still is infinitely more complicated than would be the mere matter of raising salaries. The writer remembers distinctly the remark of an educator to the effect that a certain leading university had done more important work while it was housed in wooden shacks than it had since it acquired beautiful and well-equipped laboratories and buildings.

It seems to me that what the instructional staff of universities and colleges needs is *recognition.* By recognition I mean academic recognition which would allow these men the time and facilities to undertake researches. By academic recognition I mean support and encouragement of the staff as well as of the students who give promise of making noteworthy contributions to letters and art as well as science. In order to impress the reader with the importance of this, let me quote W. R. Whitney:

"We are generally superficial. The interesting lives of a few exceptionally able American inventors have led us to overprize engineering short cuts. We are patenting inventions at the rate of nearly 50,000 a year, but very few Americans are advancing the sciences at all. We need to be told that beneath national supremacy must lie some sort of national foundation, and if we are considering technical, industrial or engineering supremacy, we must expect to need some constructive work in the bases of physics, chemistry, electricity, etc."

These remarks might sound rather academic, particularly to the materially successful man in the ordinary sense of the word; but as the war of the last five years has shown, and as any one who is willing to look up the history of ancient civilizations such as those of Athens, Sparta, Rome and Egypt will find, in the last analysis our national greatness in a generation or two will depend upon and will be in the measure of our fundamental contributions to the arts, letters and pure and applied sciences—and in the last-named classification I include all engineering activities. What we need is academic recognition, community and state recognition and national recognition of students and instructional staffs who show promise or do actually attain leadership in pure and applied politics, in pure and applied economics, in pure and applied art and in pure and applied science, including not only chemistry, physics and mathematics and all their engineering applications, but also the pure sciences of biology, psychology and their medical applications.

What is needed is a sane, sound, spontaneous and genuine recognition. The kind of recognition needed is the kind that Greece accorded to its athletes by tearing down part of the walls of the city to show that " 'tis not the walls that make the city, but the men," and that a city which had such men did not need its walls. It is this type of recognition—spontaneous, whole-hearted, accorded by an intelligent, educated, appreciative public —that is needed.

In the extraordinary times in which we are living, with Europe war-torn, her central nations unsettled, Russia a prey to the bolsheviki, China still slumbering, Japan expanding, the Near Eastern problem unsolved—and these things all unfortunately do affect our national and international policies and render them more complicated—let us recognize the necessity pointed out by B. H. Behrend more than a year ago "to turn to our schools and colleges and demand a degree of excellence such as we have demanded in our industrial achievements on the largest scale imaginable, with unparalleled and unexampled results. Then, and then only, may we face the future calmly; thus, and thus only, can we merit our place as the arbiter of the world."

Yes, let us demand "Homeric excellence" from our schoolteachers and university men, and in proportion to their "Homeric excellence" let us reward and honor them.

Lockport, N. Y. N. S. DIAMANT.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Itemized Cost of 33,000-Volt Line and Substation

ABOUT $16,700 was the cost of a 2,250-kva., 33,000/-2,300-volt outdoor substation and $13,300 was the cost of a 1.5-mile (2.4-km.) feeder line completed in the Middle West in March, 1919, itemized costs being shown in the accompanying tables. The transformers in the station were old indoor transformers made over for out-

TABLE I—COST OF 1.5-MILE, 33,000 VOLT LINE TO 2,250-KVA. SUBSTATION

	Item	No.	At	Cost
A.	Copper wire, all sizes	10,505	$0.29029	$3,049.46
B.	Insulators	500	.....	845.16
C.	Reels	1	.....	1.50
D.	Cedar poles	98	29.33	2,872.15
E.	Cross-arms	165	1.54	254.61
F.	Angle-iron cross-arm braces	145	1.135	164.56
G.	28-in. braces	8	0.146	1.17
H.	Iron pins and thimbles	335	0.624	209.04
I.	Pins, all kinds	428	.....	88.14
J.	Pole steps	2,665	0.0502	133.39
K.	Guy wire	4,645	.....	109.33
L.	Ground supports	90	1.117	100.53
M.	Bayonets	40	0.635	35.40
N.	Miscellaneous hardware	.....	.....	177.78
O.	Miscellaneous material	.....	.....	127.54
P.	Labor	.....	.....	2,465.18
Q.	Storage, freight and trucking	.....	.....	779.41
R.	Ford automobile	.....	.....	486.83
S.	Liability insurance	.....	.....	139.82
T.	Contingencies	.....	.....	10.75
U.	Engineering and supervision	.....	.....	1,234.52
	Total			$13,286.27

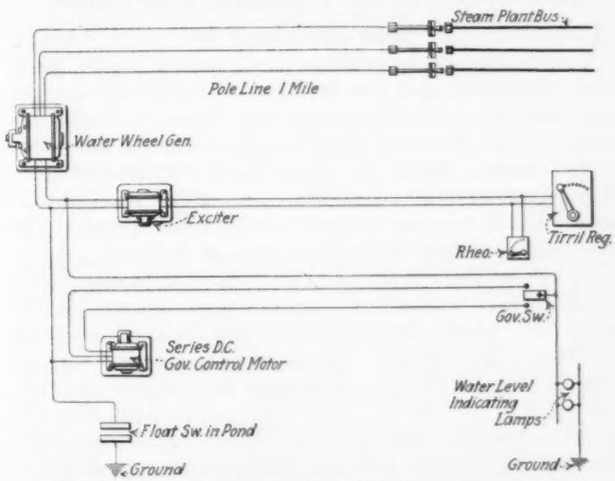
door service and the cost of the change only is included (b). One set of lightning arresters (a) is at each end of the line, and no oil switches are included in the costs, though the four bushing transformers (1) which were installed in the KO-26 oil switch at the substation are listed at $434 each. The ten disconnecting switches (h) are at the central-station end, as well as the majority of the 1,000,000-circ.mil cable (1) which feeds three 3,750 kva. transformers about 110 ft. (33 m.) from the 2,300-volt buses. The tubing in (l) was used for high-tension buses and connections at both sides. The twenty 70,000-volt insulators (k) are likewise in the central station, as are three roof bushings (c). Three more bushings were installed at the same time for a future feeder, but they have been charged only in the labor and miscellaneous materials items. The secondary meters and switches are in a small steel switchhouse at the substation. The line was run with No. 2 solid copper on pin-type insulators supported on 60-ft. (18-m.) cedar poles.

TABLE II—COST OF 2,250-KVA. OUTDOOR SUB-STATION FOR TRANSFORMING FROM 33,000 VOLTS TO 2,300 VOLTS

	Item	No.	At	Cost
a.	Banks of outdoor lightning arrestors	2	$2,600	$5,200.00
b.	Changing transformers, bushing and supplies	.....	.....	1,565.25
c.	Roof bushings	3	91.67	275.00
d.	Potheads for 1,000,000-circ. mil cable	18	8.55	153.90
e.	Copper tubing and cable	.....	.....	832.76
f.	Copper	.....	.....	25.36
g.	Disconnecting switches	3	21.67	65.00
h.	Disconnecting switches	10	46.56	465.60
i.	G-1 bus insulators	10	10	100.00
j.	Insulators	10	0.152	1.52
k.	20,000-volt pin insulators	20	9.55	191.00
l.	Bushing transformers	4	434	1,736.00
m.	Relays	.....	.....	139.25
n.	Pipe and pipe fittings	.....	.....	16.75
o.	Conduit	1,100	0.05203	57.23
p.	Cross-arm braces	4	0.092	0.37
q.	Panels	2	700	1,400.00
r.	Panel cut-out	1	1.20	1.20
s.	Structural material	.....	.....	411.95
t.	Foundations	.....	.....	315.45
u.	Link and fabric fence	185	.....	179.00
v.	Miscellaneous hardware	.....	.....	159.14
w.	Miscellaneous material	.....	.....	246.31
x.	Labor	.....	.....	1,528.03
y.	Storage, freight and trucking	.....	.....	468.65
z.	Liability insurance	.....	.....	29.47
aa.	Contingencies	.....	.....	21.87
ab.	Engineering and supervision	.....	.....	1,112.14
	Total			$16,698.20

Home-Made Remote Control for a Small Water Power

REMOTE control of a small Western hydro-electric plant was accomplished by running two light control circuits to the main steam plant one mile (1.6 km.) away. Remote control was thought advisable in this case because the size of the hydro-electric plant did



TIRRILL REGULATOR USED TO CONTROL WATER TURBINE ONE MILE AWAY

not warrant maintaining an operator, yet there were times of light load when this plant could carry the total output. Therefore, as the hydro-electric plant was fed through the busbars at the steam plant, it was decided that the Tirrill regulator connected to the bus in the latter could control the voltage of the hydro-electric plant when operating alone. This necessitated a small circuit for carrying only the exciter-field current of the hydro-electric plant to the Tirrill regulator.

When the hydro-electric plant is operating alone this regulator controls the voltage on the exciter field of the hydro-electric plant in accordance with the bus voltage

at the steam plant. For controlling the gates on the water turbine a line of copper-clad No. 10 wire was run to the governor motor in the hydro-electric plant. By this means the speed and load of this plant are controlled from the steam plant. In order to let the steam-plant operator know when the water in the pond is low, a float switch is arranged to make contact with a grounded connection, which causes two signal lamps in the steam plant to light as they are connected from ground to one of the control wires. FRANK D. ELWELL.

Dayton, Ohio.

Fish Keep Water Fresh in Cooling Towers

BY PLACING carp in their cooling towers, the Utah Power & Light Company has solved the troublesome problem of preventing an accumulation of algæ and other water growths. This company studied the problem for some time without success until the present system of keeping the cooling towers stocked with fish was hit upon. Chemical solutions designed to prevent water life did not seem to help, but shortly after placing a few carp in each tower the water cleared up, and it has since remained in a satisfactory condition. The fish require no special care and do not interfere with the purpose for which the cooling tower was designed. This method has proved so simple and satisfactory that it is being adopted by other Western companies to meet similar conditions. L. J. MOORE,

Electrical Engineer.

San Joaquin Light & Power Corporation,
Fresno, Cal.

How Electrode Regulators and Proper Reactance Help Furnace Operation

ALL electric furnaces demanding 300 kv. or more of power should be equipped with automatically regulated electrodes, and the impedance of the furnace circuit should be proportioned to give a power factor between 80 per cent and 90 per cent for normal operation on hot metal. Such was the gist of recommendations of a recent conference of engineers which studied furnace loads from the central station's viewpoint. The conclusions of this conference were as follows:

"When an electric arc furnace is used for melting cold scrap, certain momentary fluctuations in power demand will occur which are so violent that neither electrode regulators nor feeder regulators can respond quickly enough to suppress circuit voltage fluctuations entirely, especially if the furnace is of any appreciable size and is somewhat removed from the generating station. As electrode regulators, however, will immediately endeavor to restore the equilibrium, the fluctuations will not persist for as long a time or be quite as frequent as when electrodes are controlled by hand. After cold scrap has been melted down very violent fluctuations do not as a rule occur. The committee therefore feels that all furnaces demanding power in quantities of 300 kv. or more should have automatically regulated electrodes.

"The impedance of the furnace circuit is the only limiting factor controlling the more violent fluctuations. The committee recommends that the impedance of the furnace circuit shall be such, either by inherent transformer reactance or by installation of external reactance, that the furnace, when operating normally on hot metal, shall operate at a power factor not less than 80 per cent and not more than 90 per cent."

Bearing Clearance Measured with Lead Fuse Wire

THE efficiency of operation of a steam turbine depends to a great extent on the condition of the bearings and lubricating systems. Therefore they should be carefully watched for any trouble. Bearing clearance on turbo-generators of 200 kw. to 5,000 kw. should be kept from 0.005 in. to 0.0010 in. (0.12 mm. to 0.25 mm.). This clearance may be tested by use of a lead fuse wire. After removing the top shell of the bearing two or three pieces of this wire are placed on the journal, and then the top shell is replaced and bolted down to its usual position, thus flattening the soft wire to the thickness of the clearance. The fuse wire is removed and by measuring with a micrometer the clearance is ascertained. If a bearing is allowed to run loose, the journal will wear out of "round" and eventually cause serious trouble.

As important as the bearings is the condition of the oil which lubricates them. Some oils form a thick coating on the oil-cooling coils, and this makes an effective heat insulator, preventing proper cooling of the oil. Therefore it is advisable to install a thermometer in the oil lines feeding the bearings and coming from the bearings. Records of occasional readings on these thermometers will show any excessive temperature rise so that the trouble may be investigated. Although the thrust bearings of steam turbines sometimes reach a temperature of 175 deg. Fahr. (65 deg. C.) without causing damage, they should, if possible, be kept below 160 deg. Fahr. (50 deg. C.). THOMAS HALL.

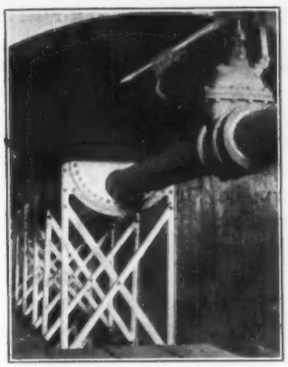
Ridgway Dynamo & Engine Company,
Ridgway, Pa.

Handling Ashes from Twenty-two Boilers by Centrifugal Pumps

BY USING water to wash away the ashes from twenty-two 500-hp. Babcock & Wilcox boilers in the Lake Linden (Mich.) power plant of the Calumet & Hecla Mining Company only two eight-hour shifts of two men are required. In this system the ashes are dropped from ash hoppers into a 30-in. (75-cm.) semicircular steel trough, supported on a metal framework as shown in the accompanying photograph. The ash hoppers are large enough to hold the ashes from two cleanings of the boiler under any conditions, and if the coal is of a fair quality, the hoppers will hold three cleanings of ashes. The pipe leading into the trough is an 8-in. (21-cm.) water main, and after the valve in this main has been opened the ashes are gradually dropped into the trough and washed away to centrally located pumps. The troughs are arranged in the shape of a letter H with boilers along each side and with the dumping place for the ashes in the center. The ashes are washed on to a grating from each side and dropped down into duplicate centrifugal pumps each of which is of sufficient capacity to handle the ashes. Any large pieces of clinker are broken up when they get on to the straining bars.

The storage capacity of the ash hoppers permits the use of only two shifts of ash handlers, each working eight hours. Two men work from 7 a.m. to 4 p.m., and two others work from 7 p.m. to 4 a.m., with one hour off each shift for meals. This leaves a three-hour stretch between each shift and two meal hours when there are

no ash handlers on duty. In this way it requires only thirty-two man-hours to handle about 50 tons of ashes, which is at the rate of more than 1.5 tons of ashes per man-hour. This proved a very convenient and economical method of handling the ashes in the power house, but the principal gain over the old ash-car system is in the elimination of the cost and inconvenience of attempting to remove the ashes in cars.



ASH TROUGH AND WATER CONNECTIONS FOR REMOVING ASHES BY PUMPS

The pumps each have a maximum capacity of 1,800 gal. per minute (110 l. per second) against a hydraulic head of 30 ft. (9 m.). Each pump is driven at 510 r.p.m. by a belt from a 50-hp., 440-volt, three-phase, 25-cycle, 750-r.p.m. squirrel-cage induction motor. The pump impellers were specially designed of hard cast iron to withstand the action of the ashes. It has been found that the impellers have to be renewed about every seventh week, and the cost of every such change is about $30. The pumps are so connected that they may be operated independently or together, as desired.

ARVID BAALACK,
Calumet & Hecla Mining Co., Mechanical Engineer.
Calumet, Mich.

Street Light Troubles Caused by Bugs

SOME unusual troubles from bugs and breakage of globes have been encountered in the lighting fixtures of Lincoln Park, Chicago. This park lies along the shore of Lake Michigan, and at certain seasons of the year numbers of small semi-transparent sand flies settle in droves on the globes, in some cases completely covering them. Their bodies stick to the globe and melt and no ordinary solvent has been found to take them off. Scouring with sand is the only ready method of removing them. Another source of trouble is spiders and spider webs, which accumulate on the compensator, socket and interior of the globes. As many as 200 or 300 spiders have been found in one globe. For removing them air is blown into the globe through a small nozzle supplied with air from a tank carried on a tower wagon.

Breakage of globes is another serious source of loss encountered. During 1919 171 20-in. globes of Alba glass which cost about $16.40 each were broken, amounting to 10.45 per cent of the total number installed. This breakage is caused by malicious throwing of stones, by vehicles colliding with the lamp posts and by handling the globes for cleaning, etc. In handling the globes, as their cost is so high and as the cleaner sometimes is seriously injured, only careful and trained men are used. They work from a wagon tower. Dry rags are ordinarily used in this work, and waste saturated with alcohol is employed to remove sticky substances. The cleaners first replace lamps reported "out" the night before, which average two or three per man, and then start cleaning. The number cleaned varies from forty to seventy per day, depending on the weather.

C. S. SHEPHERD,
Chicago, Ill. Electrical Engineer.

Accurate Timer Holds Voltage Constant When Testing Meters

FOR testing watt-hour meters a device has been developed by the Merchants' Heat & Light Company, Indianapolis, Ind., which allows the meter to run exactly thirty-six seconds, or one-hundredth of an hour. By this instrument computations of the meter speed are greatly simplified. The operation of the equipment is as follows:

Alternating current passing intermittently through the series arc-lamp coil *C* moves a ratchet wheel carrying pins which close contacts energizing first a coil *A*, which closes the meter potential circuit, and thirty-six seconds later energizing coil *B*, which opens the circuit. A clock pendulum carries a pin which swings the sector of a small meter gear in alternating directions. When the sector swings to the right it rests on a pin connected to one 2,300-volt terminal of a potential transformer. The other side of the transformer is connected to the brass base in which the sector is pivoted. The

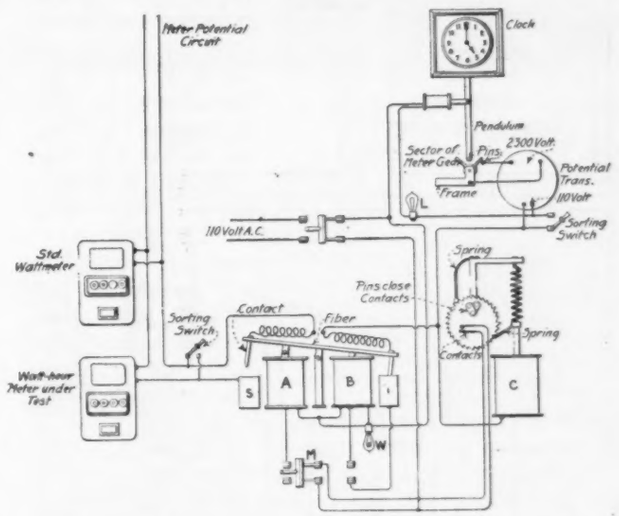


DIAGRAM OF DEVICE FOR TIMING WATT-HOUR METER

2,300-volt side of the transformer is thus short-circuited. The 110-volt side is connected across a 110-volt alternating-current line in series with the coil *C*, the lamp *L*, which limits the current, and the auxiliary coil *D*. When the high-voltage side of the transformer is short-circuited its induction is low, and current passing through *C* pulls down the core to which is attached a spring which moves the ratchet wheel one notch. On the wheel are two pins which close two spring contacts.

To start, the switch *M* must be thrown to the left. Then, when the contacts first close they energize the coil *A*, which closes the potential circuit on the meter through the contact, which is lowered into the mercury in the brass cup *S*. The spring contacts will again close in exactly thirty-six seconds. In the meanwhile the switch *M* must be thrown to the right. When the contacts again close, the coil *B* is energized, opening the meter circuit, short-circuiting the coil *C* and thus stopping the motion of the wheel. The lamp *W* lights as a signal. The auxiliary coil *D* was attached to assist the clock spring in swinging the pendulum, but it was found to be unnecessary with a good clock.

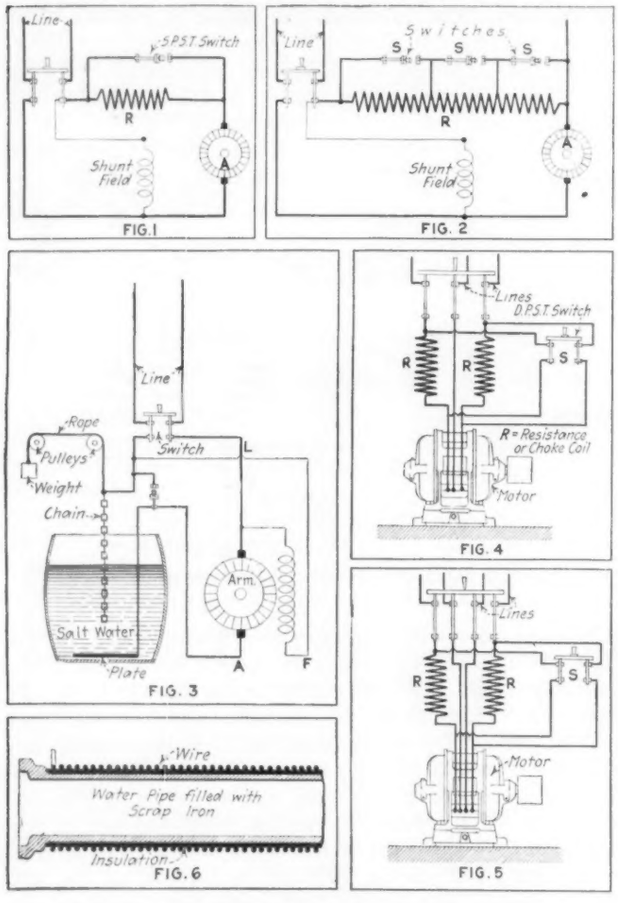
A single-pole switch is connected to the potential leads so that the meter may be run for trial.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Home-Made Emergency Motor Starters

UNDER conditions where it is necessary to start a motor without the use of its regular starting devices the emergency methods outlined here have proved very useful. In the case of small direct-current motors up to 25 hp. an emergency starter can be made of iron wire, such as bale wire, fence wire or stove-pipe wire, wound in open spirals or on wooden sticks with switches connected so that the starting resistance can be



EMERGENCY STARTERS FOR DIRECT-CURRENT AND ALTERNATING-CURRENT MOTORS

shorted. For small motors a single step (Fig. 1) will answer, while for larger motors two or more steps are advisable (Fig. 2). The field should be connected so that its current does not go through the starting resistance. Larger direct-current motors up to 100 hp. or more can be started on a water barrel. The best upper terminal for this barrel is a piece of chain as its loose construction gives a large number of contact points and low resistance when it is lowered to the bottom of the barrel. For motors over 25 hp. a switch to short-circuit the water barrel after starting is advisable. If the barrel is of metal, it should have wooden slats arranged inside to prevent accidental contact with the chain.

Alternating-current motors can be thrown directly on the line with less chance of trouble than can direct-current motors, and in case of damage to a starter this method can often be used for motors as large as 20 hp. An emergency starter for alternating-current motors may be of either the resistance or the impedance type. A resistance starter made of iron wire, box strap or any available resistance material which will carry the current should usually give the motor about 50 or 60 per cent of voltage at the start. Fig. 4 shows the arrangement for a three-phase motor and Fig. 5 for a two-phase motor, *RR* indicating the starter resistances and *S* a two-pole switch for short-circuiting them after the motor is up to speed.

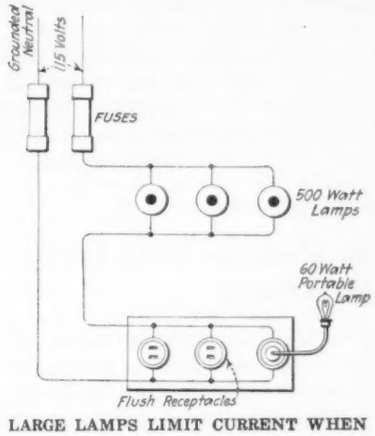
With a resistance starter all power not used by the motor is wasted in the resistance, and to reduce this waste it is sometimes desirable to use impedance or choke coils, particularly for large motors. Usually the only impedance coils that can be obtained in the field are transformers. By connecting a transformer winding in each phase (at *R*, Figs. 4 and 5) the motor can be started just as if resistance were used. The windings used should be able to carry full motor current, and the other windings of the transformer should be left open and carefully insulated, as nearly full voltage will be induced in them. Impedance coils can be made by winding insulated wire around iron cores such as iron water pipes filled with scrap iron. The better the magnetic circuit the greater choking effect will be obtained; therefore, it is well to lay the two coils close together so that the iron in one will help the other. A starter of this kind built to start a 400-hp., 6,600-volt motor was made with a coil in each phase consisting of about 500 ft. (150 m.) of No. 14 (2.1 sq.mm.) bare iron wire. The 12-in. (30-cm.) pipes were first lagged with wood and then the wire was wound on tightly with occasional staples to hold the turns ¼ in. (6 mm.) apart. The wire was a little too light for the job, and the pipes were placed in a tank of transformer oil, but even then it ran hot on every start and burned in two occasionally. The resistance or impedance starter gives a very smooth start.

On another occasion the same 400-hp., 6,600-volt synchronous motor was started by connecting directly to a 1,200-kva. generator after the voltage at the generator was reduced to 4,800. The voltage drop on the line with the heavy, low-power-factor starting current was about 1,000 volts, giving 3,800 volts, or about 58 per cent of rated voltage on the motor. As the motor came up to speed the voltage was slowly raised at the generator until 6,600 volts was reached, after which the motor field was connected to the line. Several starts were made in this way without difficulty of any kind.

Cleveland, Ohio. JAMES DIXON.

Large Lamps in Series with Portable Lamps Save Fuses

BY CONNECTING three 500-watt lamps in series with receptacles for 60-watt portable lamps in the Missouri, Kansas & Texas railroad shops at Parsons, Kan., a large number of fuses have been saved. The rough usage given flexible cords and portable lamps in this shop formerly resulted in the loss of much time and many fuses from short circuits. When a portable lamp is short-circuited the men usually try it on another circuit to find out if the portable or the circuit is at fault, with the result that a second set of fuses is blown. The entire trouble has been eliminated by connecting a bank of three standard 115-volt, 500-watt lamps in parallel, with one lead from the bank connected to the lighting circuit and the other lead to a group of the receptacles used for portables. The other side of the lighting circuit leads directly to the receptacles, which are installed in groups of three on convenient pillars in the building. By this arrangement when one of the portables is short-circuited the three large lamps in parallel limit the current to about 14 amp. or 4.5 amp. per lamp. As the fuses in this branch circuit are rated higher than 14 amp. they will not be blown. In fact, all of the portables may be short-circuited without materially increasing the current above 14 amp. In order to indicate that a portable is short-circuited a hole is cut in the bottom of the protecting iron box in which the large lamps are mounted so that they may be seen when they light. In addition to indicating a short-circuit, the lamps indicate and also protect against a grounded portable lamp or cord. In order to insure this, the large lamps are always connected to an outside wire of the three-wire, grounded-neutral lighting circuit. When operating normally the voltage drop across the three large lamps in parallel is only about 4 volts for each portable in use on a receptacle, so the portable lamps burn with sufficient brightness for the mechanic's needs.



LARGE LAMPS LIMIT CURRENT WHEN PORTABLE LAMP IS SHORT-CIRCUITED

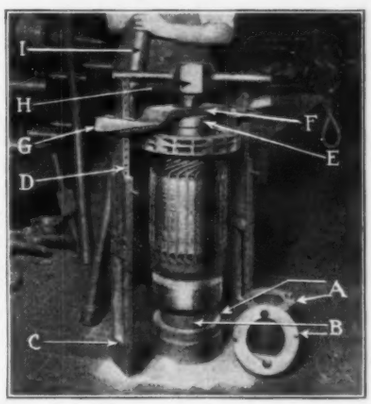
C. H. GRIFFITH,
Electrical Engineer.
Parsons, Kan.

Method of Tightening Commutators on Large Motors

THERE are two general methods of clamping and holding commutators on direct-current motors—the bolted and the ring-nut methods. In the first instance a number of hexagonal-headed bolts are equally spaced around the V-ring. These are drawn tight by means of a standard socket wrench. For the ring-nut method of tightening the commutator a small ring nut is threaded on the commutator bushing. The side of this nut is drilled with two small holes in which dowels on a special spanner wrench are engaged to draw this nut into place.

It is usually a rather difficult matter to obtain a tight commutator when a ring nut is used, even where a suitable spanner wrench is available, as there is a tendency for the dowels on the wrench to slip out of the holes in the ring nut. In order to avoid this trouble the workman will resort to a hammer, a chisel or a punch, and as a result the nut is soon ruined.

In order to obtain a foolproof method the simple apparatus illustrated here has been developed. The commutator, after being heated to approximately 125 deg. C., is up-ended and placed in the fixture as shown, with the small dowel pins on the cast ring *B* fitting in the holes of the ring nut. This cast ring is made in various sizes to receive different sizes of ring nuts. Two large holes are drilled in *B* as shown, to engage the two dowels on casting *A*. The armature is then locked just tight enough to hold the dowels on ring *B* in the dowel holes on the ring nut in such a manner that the armature may be rotated. The upper end of the armature is held by means of the structure, which consists of parts *C* and *D*, the metal collar *E* and the clamping plate *F* being placed in position with the wrench *H* fitted on the armature shaft. By means of the iron pipe *I* the armature can be rotated to draw the ring nut into place, thus producing a tight commutator.



DEVICE FOR TIGHTENING RING-NUT-TYPE COMMUTATOR

The parts labeled are used as follows: *A*—Heavy casting fastened securely to floor. *B*—Cast ring which fits on *A* and receives ring nut. *C*—Two slotted metal bars held securely on floor of shop supporting bars *D*, which have equally spaced holes for height adjustment. *E*—Metal collar used as a filler and seat for clamping plate *F*, which is a metal clamping plate placed on top of armature. *G*—Wooden wedges used to take up slack between clamping plates and adjusting pins *D*. *H*—Heavy socket-type wrench that fits end of armature. *I*—Iron pipe to increase leverage on wrench *H*.

J. S. DEAN.
Westinghouse Electric & Manufacturing Co.,
East Pittsburgh, Pa.

Electric Ovens Bake 11.6 Lb. of Green Cores Per Kilowatt-hour

AN AVERAGE weight of 11.6 lb. (5.26 kg.) of green cores has been baked with an energy consumption of 1 kw.-hr. in tests made at the Muncie Foundry & Machine Company, Muncie, Ind. The cores which were dried varied from small piston cores weighing 1¾ lb. (750 gr.) to large chunk cores weighing 128 lb. (58 kg.) each. The weight of cores which could be dried per kilowatt-hour varied with the size of the cores and ranged from a minimum of 10.88 lb. (4.93 kg.) to a maximum of 14.6 lb. (6.62 kg.) per kilowatt-hour. During the period of the test a total of 108,730 lb. (49,200 kg.) of cores were dried, with an energy consumption of 9,389 kilowatt-hour.

These tests were conducted in four ovens, each having a connected load of 72 kw. in heaters. The results proved so satisfactory that twenty-four additional ovens of the same capacity have been ordered by the same concern. This will give a total connected load of about 2,000 kw. and an estimated monthly energy consumption

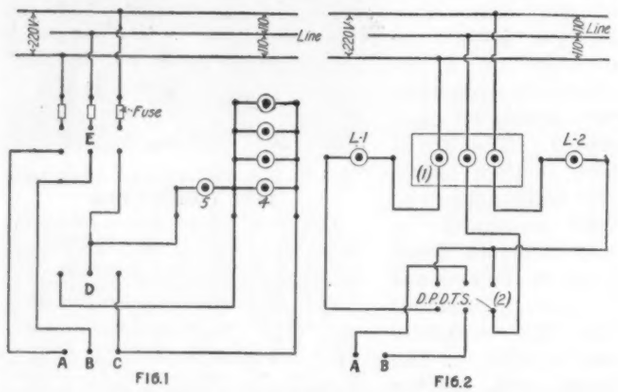
of 550,000 kilowatt-hour at 100 per cent power factor.

Although the cost of power for the electric oven exceeds the fuel bill of the old fuel-fired ovens, the greatly increased production and the assurance of getting perfectly baked cores continuously with a minimum of attention was considered as more than offsetting the increased operating cost.

These data were presented at the Fort Wayne meeting of the Commercial Section of the Indiana Electric Light Association in a paper on "Industrial Heating" by R. Thurman, new business manager of the Indiana General Service Company.

Easily Made Test Boards for Repair Shop

A TEST board suitable for a shop repairing small motors, both direct and alternating current, is shown in the accompanying drawing. This board is 24 in. long and 14 in. high (60 cm. x 34 cm.). In Fig. 1 only



FIGS. 1 AND 2—CONNECTIONS FOR REPAIR-SHOP TEST BOARD

Fig. 1—For direct-current 110-volt test attach test leads to *BC*, close switch *E* and throw switch *D* to left. For direct-current 220-volt test attach test leads to *AC*, close switch *E* and leave switch *D* open. For 110-volt direct-current direct—that is, for running motors, etc., without any lamps in series—attach test leads to *BC*, close switch *E* and throw switch *D* to the right. For 220-volt test, attach test leads to *AC*, close *E* and throw *D* to right.

Fig. 2—For 110-volt test, throw switch 2 to the right, test leads attached to *AB*. For 220-volt test, throw switch 2 to the left, test leads attached to *AB*.

the direct-current wiring is shown. The alternating-current wiring is an exact duplicate.

In wiring the board a three-wire, 110-220-volt direct-current line is connected to the three-pole, single-throw fused switch *E*. *A*, *B* and *C* are the three binding posts to which test leads are attached, but only two test leads should be used, one permanently attached to *C* and the other shifted from *A* to *B* for 220 volts and for 110 volts respectively. For 110-volt tests with lamps in series switch *D* is thrown to the left and the current may be regulated by the four lamps. For 220-volt tests the leads are connected to *A* and *C* and switch *D* is left open. If *D* is closed and a heavy current is drawn by the tested apparatus, the lamp (4) may burn out. For direct connection to the line the switch *D* is thrown to the right.

Another convenient board, shown in Fig. 2, gives 110 or 220 volts through a lamp resistance. The line comes into the board through the fuse block (1), the outside wires each leading to a lamp and the neutral to the double-pole, double throw switch (2). On the posts *A* and B 110 volts or 220 volts may be obtained by throwing the switch respectively to the right or the left.

Bronx, N. Y. C. A. JOHNSON.

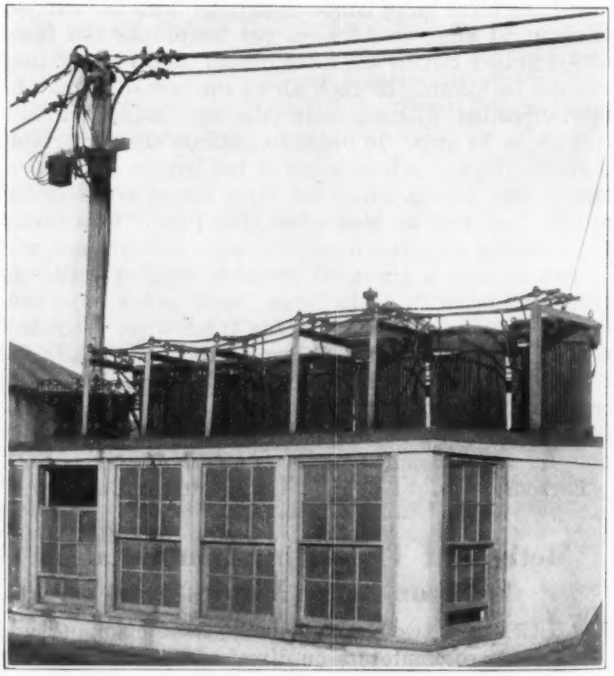
Graphic Ammeter Adapted for Use as Voltmeter

IN SOME recent tests on variation of service voltage on a 250-volt direct-current line an Esterline graphic shunted ammeter was employed as a voltmeter by connecting a suitable resistance in series. Measurements showed that the ammeter without its shunt took 0.29 amp. at 60 millivolts for full-scale deflection. For 0.29 amp. at 250 volts 862 ohms would be required. Therefore an 860-ohm, 1-amp. continuous-duty resistor was purchased. The 1-amp. resistor was large enough to eliminate heating and consequent change of resistance. As the tests did not require extreme accuracy, this resistor answered the purpose and a special resistance alloy with zero coefficient was not required. Eight dollars spent for this resistor saved the expense of a graphic voltmeter—$125. E. E. GEORGE.

Chicago, Ill.

Penthouse Above Machine Shop Used as Substation

A SEMI-OUTDOOR substation has been provided in a Massachusetts factory by utilizing a penthouse above one of the machine rooms and mounting the transformers on the 6-in. (15-cm.) reinforced-concrete roof. Inside the inclosure was mounted the main service switchboard, with the principal oil switches and metering equipment, the floor being left open to form a grated ceiling for the room below. Planking provides a path for walking about in the switch room without interfering with the ventilation of the shop below. The transformer banks are connected to cables carried on porcelain insulators mounted on angle iron frames, and the principal overhead circuits are provided with pole-type disconnecting switches as shown.



TRANSFORMERS ON TOP OF PENTHOUSE AS SUBSTATION WITH SWITCHBOARDS INSIDE

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

A Case Where Public Suffers More Than Utility

WORKMEN in Flint, Mich., lost $52,000 in wages because a tree was felled across a 140,000-volt line of the Consumers' Power Company and interrupted the supply of energy to the factories in which the men worked. In comparison with this loss the cost of repairs to the company's equipment—$8,000—was small. The tendency of the general public to think that the company is the sole sufferer when its lines are put out of commission received a check when the facts about the accident were made known through the local press, which pointed out that much the larger part of this loss from an act of carelessness came out of the pockets of workingmen and not out of the utility treasury. Such occurrences drive home to the consciousness of the people the way in which electrical service is bound up with the welfare of the community and the interest that every one has in the uninterrupted operation of the plant.

How a Western Company Caused a Wide Distribution of Stock Among Customers

THE sale of stock to customers is becoming recognized as a permanent part of central-station policy in maintaining public good will. The results obtained by the Pacific Power & Light Company of Portland, Ore., in its recent campaign for the sale of stock to customers indicate that correct sales methods make it possible to insure a wide distribution of the shares sold among both small and large users of service.

Preferred stock was used as a basis for the campaign, which was opened through the district offices with a newspaper advertising broadside and by mailing circulars to customers with monthly bills. Certain banks and investment houses later handled the stock, and the employees of the company were encouraged to sell shares on a commission. The ideal result aimed at was to secure as large a number of shareholders among customers as possible, and in consequence the most desirable sale was one of a small number of shares. With this end in view commissions were graduated so that a number of small sales brought higher returns than one large scale. On a one-share cash sale, for instance, a commission of $3 was allowed, while two shares sold to the same customer brought only $3.50. Individual commissions were allowed even if the sales were made to different persons in the same family. In practice this method worked very well, and few instances of artificially divided sales occurred. About $300,000 worth of stock was sold altogether, at least $200,000 worth being subscribed by customers. Six hundred customers in all are now on the books, the number of shares held by each customer averaging about three.

Following the active campaign, advertisements continued to be inserted from time to time in the newspapers and stock was handled by local banks. A transfer agent in Portland handles the details of the sale for the company. Stock is also sold on the installment plan, allowing 6 per cent on deferred payments.

Power Versus Lighting Rates for Moving-Picture Machines

BY KASSANDRA

WHEN central-station service is alternating current and must be transformed to direct current by a motor-generator for the operation of moving-picture machines, the claim is often made that this service should be charged at power rates rather than at lighting rates, and the decisions have almost always been that the power rate is the proper one. In the writer's opinion this is the correct decision, but the reason is not that the current is transformed by a motor-generator rather than by a transformer. While the work done is in one sense lighting, the characteristic of the demand is a power application and not a lighting application.

When power rates are allowed for electric heating it is clear that a luminous radiator is permissible if it is used only for heating and not to replace lighting. If resistances are used to charge a storage battery at a voltage lower than the supply voltage, such resistance could be replaced by bank of lamps. Here again it is understood that the bank of lamps is not used to replace lamps used for lighting and therefore, again, the application is entitled to the power rate. Once more, the use of electric lamps for therapeutic purposes is clearly not lighting in the ordinary sense. Likewise the signal lamps of a telephone switchboard or an electric elevator are clearly not ordinary lighting units.

One convenient test for the above and similar cases is whether the use of the lamps competes with the sun or daylight. A lighting use that competes with the sun or daylight produces the low load factor that is one of the reasons for charging a higher price for light. A lighting use like that of signal lamps or electric bath cabinets or moving-picture machines produces, by reason of the diversity factor, a load factor at the generating station similar to the load factor produced by ordinary power. It follows, therefore, that the use of electricity for the lighting of moving-picture screens—but, of course, not for the lighting of hall or entrance—may properly come under the power rate whether or not it is passed through a motor-generator. The fact that the power rate has been allowed or required for moving-picture machines in those particular cases where the power is passed through a motor-generator is not only an argument but a proof that the power rate should be allowed for all such uses. On the other hand, the allowance of the power rate in these cases should not be a precedent for allowing a customer to buy all his

electricity at the power rate and then to install a motor-generator and transform it to electricity that will replace the general lighting service.

Generally, to use motor-generators merely in order to buy at the power rate rather than at the lighting rate would be an economic waste and would only have the effect of forcing central stations to increase the price for power. On the other hand, it is perfectly sound to allow the power rate for moving-picture machines, whether the power is used directly or through a motor-generator.

Electric Range Load in a Small Town

INTERESTING data on electric range operation in a town of 5,000 people are furnished by E. A. Wright, vice-president and manager of the Great Bend (Kan.) Water & Electric Company. Mr. Wright comments on the electric range load and the revenue derived therefrom as follows:

"We find that the diversity factor of the electric ranges on our lines is very high. In one instance in addition to our regular lighting load we have nine ranges connected to one 10-kw. transformer which has a 2,200/115 voltage ratio. We have experienced no trouble from the transformer overheating and have received no complaints as to service. In fact, all of the customers using service from this transformer are highly pleased.

"For the year 1918 our cooking rate was $1.50 fixed charge per month, plus 2½ cents per kilowatt-hour. On this rate at the end of the year we had installed a total of twenty-six ranges, all but seven of which were in operation throughout the entire year. Our gross revenue from this source was $863.81 for a total kilowatt-hour consumption of 20,347. The average monthly bill per customer was $3.26, and the average rate per kilowatt-hour was 4.25 cents. Beginning with 1919, the rate per kilowatt-hour was increased to 3 cents, the fixed charge remaining the same. At the close of the year 1919 we had installed a total of thirty-seven ranges, two of which are temporarily out of service. The gross revenue from range operation during 1919 was $1,247.25 for a total kilowatt-hour consumption of 25,564. The average monthly bill per customer was $3.57, and the average rate per kilowatt-hour was 4.85 cents."

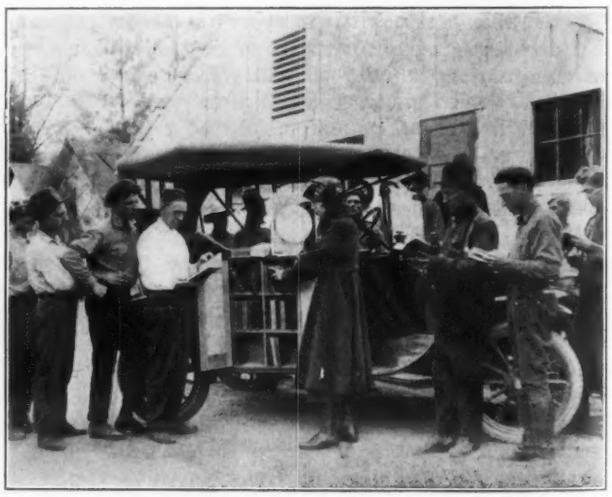
Competition in Lighting Develops Business

BY COMPARING illumination intensities in different installations it is often easy to "sell" the idea of improved lighting to customers who are uninterested in calculations. At the recent question-box conference of the New England Section of the National Electric Light Association it was brought out that the foot-candle meter in the hands of the central-station contractor-dealer or manufacturer's representative is stimulating rivalry in illumination in industrial plants and mercantile establishments. The lighting bills of one restaurant in Boston were increased $50 a month by the improved installation authorized by the proprietor when he was shown tests of his competitor's installations averaging 3 to 3.5 ft.-candles against his own average of 1.75 ft.-candles. The Boston Edison Company is taking foot-candle readings in every department of a department store and comparing them with corresponding results in other establishments, and while this survey has not yet been completed, it has already resulted in the addition of a large amount of lighting. Wherever shown, the foot-candle meter has excited interest and proved a clinching argument for better lighting with small development expense to the central station.

At the conference it was brought out that 8,000 300-watt lamps are to be used in a mill in place of 100-watt lamps because of foot-candle comparisons. In another case, where only 0.1 ft.-candle was available in the shop apart from the use of 25-watt lamps here and there near the work, 300-watt lamps on 20-ft. spacing were substituted. Little argument has been required to convince mill drafting departments with the foot-candle meter that intensities of 4 and 5 ft.-candles should give way to 25 ft.-candles. It was emphasized that in industrial plants intensities of 15 to 25 ft.-candles are coming and that close direct lighting is on the wane. The point was also made by H. D. Stokes, Worcester (Mass.) Electric Light Company, that it is unnecessary to lay out an entire mill for improved illumination. If the installation is satisfactory, it will be extended, automatically as it were, throughout the mill; if not, it will be removed.

Traveling Library in Construction Camp

A SCHEDULE of eight hours' work and eight hours' sleep leaves eight hours for idling in most "camp jobs," hours that soon become burdensome if no means of relaxation are provided. To meet this condition the Southern California Edison Company on its big construction job at Kern River Plant No. 3 has provided several interesting entertainment features. One of these is the traveling library, shown in the accompanying illustration. This library, mounted on a Ford touring car, makes regular visits to the camps and circulates books of interest to the men. The work is supervised by the Kern County Circulating Library. In this way 2,500 men have had an opportunity to keep in touch with events in the outside world.

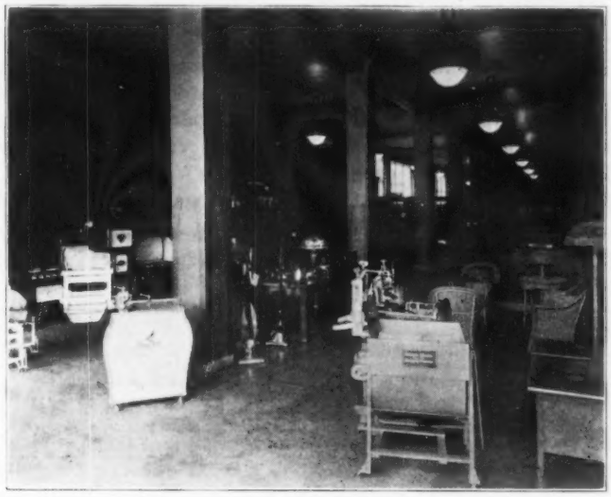


GOOD READING FURNISHED MEN ON KERN RIVER CONSTRUCTION WORK BY SOUTHERN CALIFORNIA EDISON COMPANY

Many other opportunities for enjoyment are furnished. These include baseball games and other athletic contests. Motion pictures, exhibited in the camp dining room, also serve to while away the evening hours.

An Attractive Office Is an Asset to a Utility

AN INCREASING number of central stations are appreciating the advantages of having well-appointed quarters for the transaction of business with the public. The experience of the light and power department of the Fort Wayne & Northern Indiana Traction Company, at Fort Wayne, Ind., as voiced by an officer in the following statement, is of interest:



CENTRAL STATION OFFICE AT FORT WAYNE, IND.

The front part of the office is used for the sale of electrical merchandise and has a rest room for customers. The first counter to the left is for the sale of lamps and appliances. The showcase is filled with attractive appliances, and all the lamps are kept out of sight in drawers. Further back on the left are the cashiers' cages and beyond is the billing department. Behind the information desk, which is in the right foreground, are sections for the use of the superintendent of the light and power department and his assistants. The office in the right rear is occupied by the electrical engineer. The entire room is 150 ft. by 30 ft. in size.

"It has been thoroughly demonstrated to us that the pleasant appearance of this office has made us many new friends, and we have been repeatedly told that people really enjoy coming into these quarters to do business with us."

Continuous Power Supply Necessary for Electric Furnaces*

ONE of the principal factors in the economical production of steel in the electric furnace is low consumption of reliable and cheap power. Actual cost of power is not to be considered at the expense of continuous service, and absolutely reliable continuous supply of power is the first requisite of cheap power. The following observations explain this point. A furnace was operating under an average load of 800 kw.; a breakdown in the power house resulted in the stopping of one generator supplying the furnace, which made it necessary to reduce the furnace load to 500 kw. This condition continued for one hour. During the hour the melting advanced slowly, if at all, and increased the time of the heat and also the power consumption.

Another furnace was connected to the lines of a central station having no reserve equipment; the power failed when the charge in the furnace was melted, but not hot enough to pour into molds. On receiving power the following day the solid mass had to be remelted, an operation requiring double the time and energy necessary to melt the original charge. During this remelting the hearth was cut to such an extent that patches had to be burned in before operations could be resumed. Interruptions of power became so frequent, with results as above, that the furnace had to be abandoned.

The losses that must be sustained under such conditions are measured not only in the cost of the additional power consumed, the labor wasted or the damage to the furnace, but, what is more important, in decrease of the furnace tonnage output, which controls the price of all steel produced.

A furnace load should necessarily be connected to a central station capable of turning out large blocks of energy; otherwise the heavy surges caused by the poor contact and intermittent arcs produce poor voltage regulation unless the furnace load is a small proportion of the total load connected to the power lines. Hence the smaller power companies cannot, and the less progressive will not, equip themselves to handle the new furnace loads without charging excessive rates, for they have to take account of the impossibility of selling their capacity to some other industry in case the furnace is abandoned. Since the electric furnace can compete in production with the other processes, there is no reason to anticipate an installation shutting down as long as the required reliable supply of power is furnished to the furnace.

SMALLER CENTRAL STATIONS MUST DO THEIR PART

Another point in power supply is that, owing to fixing of rates by the public service commissions and regulations affecting distribution, the small and unprogressive stations are protected from the invasion of the more progressive central stations. The following will illustrate this point: A power station of limited capacity undertook to supply a medium-sized furnace. The result was irregular service, which limited the furnace output to a very small percentage of its possible capacity. The load factor was low, with resulting large power consumption and excessive charge per kilowatt-hour.

Within a few miles of the plant thus handicapped a power company was operating with a sufficient capacity and reserve to supply this furnace with a steady supply of power at the same rates. If the operators had been able to buy their power from this larger plant, they would have been able to obtain steady power, increase their output and decrease the power consumption, so that their power costs per ton of metal would have been reduced by half and the furnace installation would have been successful instead of a burden to the operator. In the steel-castings trade there appears to be no reason why the electric furnace, which has been developed to a high degree, should not largely supplant other processes. Close cooperation between the furnace operator and the central station can aid in bringing this about quickly, but it will be necessary for the smaller power companies to do their part, as well as the more progressive stations, to help make the electric furnace a permanent success by insuring to it an adequate and continuous supply of power.

*Abstract from a paper presented by W. G. Berlin, electric furnace operator, Taylor Wharton Iron & Steel Company, before a joint meeting of the American Electrochemical Society and the American Institute of Electrical Engineers.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generation, Transmission and Distribution

Steel-Plant Power Generation from Waste Heat and Coal.—B. H. GREENE.—The author presents some of the practical problems encountered in the utilization of waste heat from open-hearth furnaces for the generation of power for steel-mill use. In this case the steam derived from waste heat was supplemented by coal-fired boilers used for electric power generation. This particular installation was made for the following purposes: (1) To utilize the waste heat of the open-hearth furnaces; (2) to assist in eliminating power shortage conditions which prevailed in the territory where this plant was located; (3) to have standby electrical service when required; (4) to be able to control peak loads occasioned by plant operation; (5) to govern power-factor conditions properly. The author enters into a detailed discussion of how these ends were attained. He predicts that the installation of waste-heat boilers or open-hearth furnaces will increase with the increased price of coal and the scarcity of the supply. Another factor advantageous to their use is the improvement in open-hearth furnace operation, which can be charged principally to better draft conditions.—Paper presented at meeting of A. I. and S. E. E., January, 1920.

Current Densities in Conductors and Cables.—E. SOLERI.—A committee having been appointed by the Associazione Elettrotecnica Italiana to revise the regulations for electric installations, the author calls attention to the fact that the current densities prescribed by the various countries are different and that these differences are sometimes important. He examines the regulations published by the electrotechnical societies in America, Austria, England, France, Germany and Switzerland, both for overhead and for underground conductors, and reports the nomination of an Italian committee for studying the regulations to be officially adopted in Italy. In the meantime he advises the adoption of the English regulations for overhead conductors and of the German ones for underground cables.—*Science Abstracts, Section B*, Dec. 30, 1919. (Abstracted from *Elettrotecnica*, Sept. 25, 1919.)

Traction

Economical Use of Energy for Car Purposes.—D. D. EWING.—It is estimated that the total energy used for traction purposes in 1917 was about ten billion kilowatt-hours, which was used for moving cars to the extent of 2,125,000 car-miles. This gives an average energy consumption of 4¾ kw.-hr. per car-mile measured at the power-plant switchboard. At 3½ lb. (1.6 kg.) of coal per kilowatt-hour the total consumption is 17,500,000 tons, or about 3½ per cent of the annual coal production. Of the 4¾ kw.-hr. only about 60 per cent gets to the cars. The author analyzes the losses at the car in order to indicate possible saving where the consumption can be reduced. He considers particularly economy through economical coasting, acceleration and control of stops.—*Electric Railway Journal*, March 27, 1920.

Applying the Automatic Substation.—C. A. BUTCHER.—An illustration of what can be saved by automatic control is furnished by a tabulated summary of a report recently made on an Eastern property operating a double-track line between two cities of approximately 200,000 population each and 80 miles (130 km.) apart. The schedule is essentially one car each way every 40 minutes. Local cars are operated on a schedule speed of 23 miles per hour (37 km.) and limited trains at 30 miles per hour (48 km). While each proposition is a study in itself the writer thinks that automatic operation should be applied to a considerably greater extent than at the present time.—*Electric Railway Journal*, March 27, 1920.

BALANCE SHEET FOR PROPOSED INSTALLATION OF AUTOMATIC CONTROL ON INTERURBAN LINE

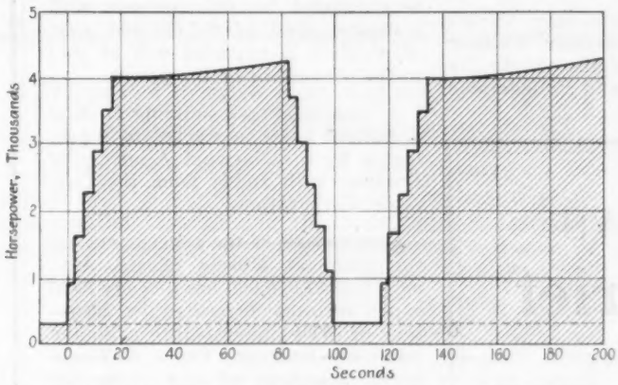
Investment required:		
Seven new substation buildings		$20,000
Eleven automatic switching equipments (including oil circuit breakers, lightning arresters, automatic high-tension transfer switching and auxiliaries)		125,400
Freight		575
Installation of switching equipment and moving old rotaries and transformers		16,300
Total		$162,275
Replacing 18.52 miles 500,000-circ.mil copper messenger with 7-16 in. galvanized messenger at $325 per mile		6,030
Taking down and reeling 66.58 miles 500,000-circ.mil copper feeder at $50 per mile		3,330
Extension of transmission line		4,350
Gross investment		$175,985
Credits:		
85.1 miles 500,000-circ.mil copper feeder at 18 cents per pound (scrap value)	$123,000	
Salvage other material	6,000	
Total		129,000
Net investment		$46,985
Annual savings:		
Operators' wages eliminated		$22,330
Power saved		2,860
Coal saved (substation heating)		200
Total		$25,390
Annual charges:		
Inspectors' wages	$4,725	
Fixed charges (except interest) on net investment	4,230	
Total		8,955
Net annual saving		$16,435
Return on investment (including 6 per cent interest)		34.9%
Return on investment (less interest)		28.5%
Total investment would therefore be returned in approximately three and one-half years.		

Installations, Systems and Appliances

High-Power Switch Gear.—MAX VOGELSANG.—An instructive article dealing with the constructional development of high-power oil breakers. A number of photographs and tracings illustrative of German practice are exhibited.—*Elektrotechnische Zeitschrift*, Nov. 20, 1919.

Electric Mill Drives.—J. D. WRIGHT.—The purpose of this article is to show how the layout of the mill and method of rolling steel affects the load cycle from which the motor capacity, size of flywheel, type of control, etc., are determined. One of the simplest of the large motor

applications is to a continuous mill such as a six-stand continuous sheet-bar or billet mill of which the load cycle is given in the figure. It is seen that the load comes on in several easy steps and remains on for some time. The duty on the motor is not severe. It is said that a total motor capacity of about 80,000 hp. has been applied in this country to this type of rolling mill. Other



TYPICAL LOAD CYCLE FOR SIX-STAND MORGAN CONTINUOUS-SHEET BAR MILL

types of mill layout considered are a three-stand combination rail and structural mill which is served by two tilting tables on the entering side of the mill and the so-called merchant mill. The author gives in considerable detail the information necessary for calculating the proper size of motor required to roll any given product.—Paper presented before meeting of A. I. and S. E. E., January, 1920.

Almost Laborless Dipping and Baking Plant.—A description of a plant for dipping, impregnating and baking armatures and field coils designed with particular reference to economizing man power.—*Electric Railway Journal*, Feb. 21, 1920.

Electrically Heated Boilers and Heat Storage.—It is pointed out that where water power is inexpensive it may be practicable to raise steam electrically. Attention is called to tests on two electrically heated boilers in Switzerland, in which it is said that 90 per cent efficiency was obtained. Several makes of boilers equipped for electric heating are described which are mostly of Swiss origin.—London *Engineering*, Feb. 6, 1920.

Electrochemistry and Batteries

Effect of Cold Weather on Electric Vehicles.—Changes of temperature affect electric vehicle batteries. The writer deals in a practical manner with the falling off in mileage capacity per charge in winter time.—*Electric Vehicle*, January, 1920.

Specific Inductivity of Mixtures.—FRITZ BANNEITZ.—Theoretical expressions for the dielectric constant of a mixture have been derived under certain simplifying assumptions. The present author reports upon some experimental investigations on what may be called "artificial mixtures," consisting of thin glass tubes filled with one of the ingredients, placed parallel to each other and surrounded by the other ingredient. The capacity of a condenser with such a composite dielectric was measured at high frequency by a wave-meter method. When the tubes were spaced relatively far apart the obtained results checked well with theory, but for closer spacings considerable deviations were observed.—*Annalen der Physik*, July 4, 1919.

Telegraphy, Telephony and Signals

A New Method for the Reception of Weak Signals at Shore Wave Lengths.—EDWIN H. ARMSTRONG.—The problem dealt with is to construct a receiver for undamped, modulated continuous and damped oscillations which is substantially equally sensitive over a range of wave length from 50 m. to 600.m., which is capable of rapid adjustment from one wave to another, and which does not distort or lose any characteristic note or tone inherent in the transmitter. Three well-known means which might be employed are: (1) Amplification of the low-frequency current after rectification; (2) amplification of the high-frequency current before rectification, and (3) application of the heterodyne principle to increase the efficiency of rectification. The author's solution of the problem, however, consists in reducing the frequency of the incoming signal to some predetermined superaudible frequency which can be readily amplified, passing this current through an amplifier and then detecting or rectifying the amplified current.—*Q. S. T.*, February, 1920.

Localization of High-Resistance Breaks in Submarine Cables.—A. POULSEN.—It is said that the Siemens method of locating breaks in submarine cables, while first proposed in 1876, is still the best method when dealing with high-resistance breaks. The method consists briefly in determining the resistance of the cable up to the break by means of a combined resistance and capacity test as follows: (1) The sum of the resistance of the cable and in the break is measured. (2) The cable is discharged through a galvanometer after having previously been charged from a battery. The theory of this method, with examples of calculations, is given.—London *Electrician*, March 19, 1920.

Dependence of Amplification Constant and Internal Plate Circuit Resistance of Three-Electrode Vacuum Tube Upon Structural Dimensions.—JOHN M. MILLER.—The amplification constant of three-electrode vacuum tubes is mathematically derived in terms of readily measurable physical dimensions of the tube. Curves are plotted enabling the rapid predetermination of tube amplification constant on this basis. The curves are shown to give results agreeing with experiment for a number of types of tubes. The internal resistance of the tube is similarly deduced, and an agreement between theory and experiment is shown. Certain deviations in specific instances are explained.—*Proceedings Institute of Radio Engineers*, February, 1920.

Amplifiers.—MARIUS LATOUR.—In 1905 the author proposed to use a three-electrode mercury-vapor tube for amplification of feeble currents, and a similar apparatus was later employed as a high-frequency generator for heterodyne reception. In an earlier article (*Electrician*, Dec. 1, 1916) the author, in analyzing the behavior of three-electrode thermionic amplifiers, introduced the classical "tube constants," namely, the partial derivatives of the plate current with respect to plate voltage and grid voltage. In the present paper a more complete theory is given, in accordance with a report prepared in 1916 for General Ferrié. The input impedance of the tube is taken into consideration, and regenerative amplifiers and self-oscillating circuits are dealt with.—*Bulletin de la Société Française d'Electriciens*, July, 1919, and *Revue Générale d'Electricité*, Nov. 22, 1919.

News in Brief

SUMMARY

of Important Happenings in the Industry During the Week

FREIGHT shipments are improving. Demand for conduit, flexible armored conductor, wire and porcelain fittings is heavy and greatly exceeds present shipments. In the East and Central West much trucking has been done to relieve the situation, but the amounts received either by truck or rail are small in comparison with the demand.

FEW PRICE changes are announced, a 5 per cent advance on metal molding, the same amount on certain large Westinghouse units, and an increase of $8 per 1,000 ft. on flexible armored conductor being the principal ones.

INTERCHANGE of views between Eastern and Far Western delegates is expected to mark the Electrical Supply Jobbers' Association at Del Monte, Cal., this month.

PRACTICALLY all electric ranges which have been held in stock are sold and likewise those which are en route. No more ranges are expected until the fall season except those already on order.

THE MANUFACTURE of flexible armored conductor has been negligible during the past week. Mills have been trucking almost no steel strip, and freight shipments are at a standstill, except for a few cars of finished conductor which have been loosed from the yards.

WITH strikes more or less serious under way in almost every section of the country, the suggestion is made of infusing the employee with the idea of a square deal, after having taken steps to put this idea into practice.

THE DEPARTMENT stores are coming to be regarded more and more as a real factor in the distribution of motor-driven socket devices. Their sales are heavy, especially where demonstrations are held of the devices in operation.

INTERCONNECTION of virtually all the larger systems in central and western Pennsylvania, northern West Virginia and eastern and central Ohio is predicted by A. M. Lynn president of the West Penn system.

A GREAT growth of stock sales to customers of its subsidiary companies is reported by the Standard Gas & Electric Company, stock so held now reaching $8,894,500.

AN EXPENDITURE of $1,750,000 to overcome the seepage from the Cedar Falls (Wash.) reservoir by abandoning the present dam and raising the old dam further up stream is advocated. An annual saving to Seattle of $800,000 for fuel would, it is said, result.

DEVELOPMENT of a training course in electric welding, standardization of processes and other steps to further progress in the welding industry are to be undertaken by the American Welding Society.

J. H. DEPPLER has been elected president of the American Welding Society. Sections of the society for Chicago, Cleveland and Philadelphia are being organized.

UNDEVELOPED water rights held under a state franchise do not come under the protection of the inviolability-of-contract clause of the federal constitution, according to a decision of the United States Supreme Court in a dispute between Ohio power companies over property acquired through eminent domain.

A LOW-PRESSURE steam unit of a turbine-generator rated at 60,000 kw. and built for the Duquesne Light Company has been "turned over" for the first time in the East Pittsburgh shops of the Westinghouse Electric & Manufacturing Company.

THE JOINT convention of the Pacific Coast sections of the American Institute of Electrical Engineers will be held at Portland, Ore., on July 21-24.

OPPOSITION has arisen in Maine to the proposed super-power trunk line program under federal supervision on the ground that it may nullify the Maine policy which prohibits the exportation of electrical energy from within the state.

BOSTON contractor-dealers, members of the Massachusetts State Association, agreed upon percentages of overhead ranging from 46 per cent on contracts from $200 to $450 to 10 per cent on contracts involving $50,000 and over.

ENTERTAINMENT features of the N. E. L. A. convention at Pasadena, Cal., this month are to culminate in a great electrical spectacle, "La Fiesta de Electra," on the evening of May 21.

EXISTING shortage of power has led the Public Service Corporation of New Jersey to plan the construction of a power plant with an ultimate capacity of 200,000 kw. The North Jersey Power Company is to be organized for this purpose with a capital stock of $25,000,000, part of which it is expected will be sold to the consumers of the power.

A HEADQUARTERS building to cost $1,400,000 is to be erected in Washington by the National Academy of Sciences with funds from the Carnegie Corporation.

COMPLETION of the government development at Muscle Shoals, Ala., on which $7,000,000 has already been expended, was advocated by Secretary of War Baker before a Senate committee hearing. Frank S. Washburn, president of the American Cyanamid Company, urged that the project be dropped.

APRIL issues of bonds and stock by electric public utilities show a slight decline in total value as compared with March and bear the highest rate of interest of all the year's issues.

REPRESENTATIVES of the N. E. L. A. outlined their classification of accounts before delegates of the National Association of Railway and Utility Commissions at Chicago.

MULTIPLEX telegraphy and telephony over open-circuit bare wires laid in or on the earth or submerged in water is now possible, according to an announcement made before the National Academy of Sciences at Washington by Major-General George O. Squier of the United States Army Signal Corps.

KANSAS' Court of Industrial Relations is in full operation, although the question of its constitutionality is still before the Supreme Court of the state. The first order of the new body effected a settlement of the relations of electrical employers and employees which is reported to have been satisfactory to both sides.

A REPEAL of the daylight-saving bill by the New York State Legislature will probably be vetoed by Governor Smith. Trenton, N. J., has adopted the daylight-saving plan. Opposition to it in New England has large support, though many cities and towns have put it in force.

HEARINGS on the projected St. Lawrence River deep waterway will be held by the International Joint Waterways Commission, representing the governments of the United States and Canada, from May 7 to June 29, the first hearing to be at North Bay, Ontario, on the former date.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Illinois Commission Asks Cities to Appoint Utility Inspectors

IN AN apparent effort to give the advocates of the home rule of public utilities some measure of satisfaction without sacrificing the advantages of straight commission control, the Public Utilities Commission of Illinois has invited municipalities to appoint local public utility inspectors to operate under the rules of the commission. These inspectors, who would be paid by the cities, would be expected to make frequent tests of public utility service to determine if it is in accord with the standards established by the commission. For the purpose of this inspection the commission divides the cities of the state into four classes based on population. Rules for the inspections in the various classes will be formulated by the commission later.

Twenty-five-Million-Dollar Station to Be Partly Financed by Consumers

TO MEET the existing power shortage in the north New Jersey territory and provide capital required for the construction of a power plant of 200,000 kw. ultimate capacity, the Public Service Corporation of New Jersey is planning the formation of a twenty-five-million-dollar corporation, to be known as the North Jersey Power Company, which will be partly financed by the sale of preferred stock to present and prospective power customers. In discussing the project with a representative of the ELECTRICAL WORLD, John M. O'Toole, assistant to President McCarter of the Public Service Corporation, stated that the project calls for the construction of a power plant on a site in or near Newark, which is the center of the district served by the company. At the outset it is proposed to provide an initial capacity of 100,000 kw., involving a capital expenditure of $12,500,000 within two years from next June.

Commenting on the demand for power and the company's reasons for the proposed plan of financing, Mr. O'Toole said: "At the present time in the north Jersey territory there is a power shortage of 60,000 kw. to 75,000 kw. The existing financial situation makes it impracticable for the Public Service Electric Company to finance an undertaking of this magnitude. For these reasons a plan has been outlined for the formation of the North Jersey Power Company along lines that would, in a sense, bring the electric power users into an association or copartnership with the Public Service Corporation to operate the plant in close co-operation with the Public Service Electric Company. Present power users and those whom the company has been unable to supply because of insufficient capacity are being asked to subscribe to the preferred stock of the proposed company to an amount approximating 50 per cent of what it would cost each individual subscriber to install his own power plant."

Of the authorized capitalization of $25,000,000, it is proposed to issue upon completion of the preliminary details, which will be within the next sixty days, $12,500,000 in 8 per cent cumulative preferred stock to be available for subscription by the industrial power users. Such subscribers will have preferential claims upon the power supply and guarantees of continuity of service. The proposed preferred-stock issue is to be taken in eight installments ending July, 1922, and to be retired within twenty years after July, 1924. Provision is made for a sinking fund for this purpose to be set aside in advance of dividends on common stock, and it is also provided that no bonds or mortgages shall be placed on the plant in excess of 50 per cent of the total outlay proposed. The Public Service Corporation of New Jersey, which owns all of the stock of the Public Service Electric Company, will subscribe for and own all of the common stock of the North Jersey Power Company.

Mr. O'Toole further stated that although definite arrangements have not been completed, it is expected that orders for equipment will be placed by next June and the plant will be operating about eighteen months later. Response to inquiries among power users as to their willingness to participate on the basis proposed has been very gratifying to the Public Service Corporation.

Vice-president P. S. Young stated that he felt very much encouraged at the manner in which the proposition has been received by the manufacturers and other interests requiring power. He feels confident that the plan as outlined will be brought to maturity.

250,000 Kw. to Be Interconnected in Pennsylvania-New Jersey Power System

NEW transmission lines are under construction for the Pennsylvania-New Jersey power system of the General Gas & Electric Company which will establish through interconnection with other systems a combined capacity of nearly 250,000. The three plants of the General Gas & Electric Company which are to be tied together have at present a total installed generator capacity of 79,425 kw., divided as follows: Metropolitan Edison Company (Reading, Pa.), 45,500 kw.; Pennsylvania Utilities Company (Easton, Pa.), 26,925 kw.; New Jersey Power & Light Company (Dover, N. J.), 7,000 kw. These three plants have available for sale at the present time 9,000 kw. of generating capacity, which will be increased to 20,000 kw. by the installation of additional boilers at Reading and Easton and the completion of the transmission line connecting the two plants.

The entire system will be physically connected with

the following systems for the exchange of power: York Haven (Pa.) Power Company, 20,000 kw.; Philadelphia & Suburban Electric Company (Pottstown, Pa.), 10,000 kw.; Counties Gas & Electric Company (Norristown, Pa.), 20,000 kw.; Lehigh Navigation Electric System and Lehigh Valley Transit Company, with power plants at Allentown, Hauto and Harwood, Pa., 100,000 kw. While the interconnection will establish a system of nearly 250,000 kw., the present lines will transmit only a part of this. They are, however, sufficient for the purpose and can readily be increased.

When the new lines are completed the system will extend practically from the Susquehanna River eastward through Pennsylvania and New Jersey to the territory covered by the Public Service Corporation of New Jersey and southward as far as Philadelphia. The cities and towns served by the system are of a highly industrial character with a large market for the sale of power.

Pennsylvania, Ohio and West Virginia Interconnection Predicted

INTERCONNECTION of virtually all of the larger systems in central and western Pennsylvania, northern West Virginia and eastern and central Ohio was predicted by A. M. Lynn, president of the West Penn system, in a paper read at a luncheon of the Western Geographical Section of the Pennsylvania Electric Association held in Pittsburgh on April 21. Akron, Canton, Massillon, East Liverpool and Steubenville, Ohio, are now connected through West Penn lines with those of the Duquesne Light Company, which supplies Pittsburgh and Allegheny County.

"Within three years," said Mr. Lynn, "I look to see the Republic Railway & Light Company of Youngstown, Ohio, and Newcastle, Pa., the Penn Public Service Company of Johnstown and the Monongahela Valley Traction Company of West Virginia connected together. I understand that the Penn Public Service Company lines now cross those of the Penn Central Light & Power Company of Altoona, so it appears that within a reasonable time light and power interests from central Pennsylvania to central and northern Ohio and northern West Virginia will be connected. Great advantages will accrue to these utilities and to the public."

How such an arrangement would enhance reliability of service, the various companies coming to the aid of any one of the group which might be in trouble, was outlined by the speaker, who told of receiving a long-distance call from a large central-station company in central Ohio asking if the West Penn could spare 5,000 kw. of capacity. The West Penn being short, the same request was made of the Duquesne Light Company, the idea being that if the Duquesne could spare the power requested it would turn over 5,000 kw. to the West Penn, which in turn would deliver 5,000 kw. to the American Gas & Electric Company at its Windsor (W. Va.) station, and the American Gas & Electric Company, which supplies eastern Ohio, would turn over 5,000 kw. to the company which made the original request.

The technical sessions of the section meeting were devoted to a discussion of power-factor problems. E. C. Stone, Duquesne Light Company, who presided, read a short statement of the problems, together with proposed means of solving them. He said that if the power factor on the Duquesne system could be raised to unity an additional capacity of 30,000 kw. would be available.

W. H. Pratt, in a paper on "Power-Factor and Kilovolt-Ampere Measurements," outlined the principles involved and told of difficulties encountered in designing a simple instrument which would measure power factor correctly. Recording power-factor meters are unsatisfactory, he said, because they are not accurate if the three-phase load is unbalanced. He described a voltmeter-ammeter method of measuring power factor consisting of two independent moving elements which utilize the flat portion of the sinusoidal power-factor curve.

An analysis of the power-factor conditions of the Duquesne Light Company was given by C. L. Rupert. He presented figures which showed the no-load and reactive losses of each type of circuit and each class of service.

C. W. Drake, Westinghouse Electric & Manufacturing Company, in a paper on "Induction and Synchronous Motors for Industrial Applications," told generally of the problems surrounding the installation of motors in industrial plants. Mr. Drake stated that the testing of motors in the plant will help to better the power factor.

A paper on "Power-Factor Correction" was read by Robert Treat, General Electric Company. Comparisons of static and synchronous condensers were made regarding both operation and economy.

Considerable time was devoted in the discussion to the question of billing the customer in such a manner that he would be interested in maintaining a good power factor. The word "penalty" in power-factor clauses of contracts is not desirable, it was agreed, and some simple method is needed to give the consumer a clear idea how the low power factor affects him.

Instruments for measuring power factor were discussed at length, and it was the general thought that the demand method of measuring power factor is better than the integration method.

Townley Urges Engineers to Grasp Opportunities for Leadership

THE general public looks upon an engineer as a man to be employed, and it does not realize that an engineer's training is inherently that of an employer-executive or leader, and for this reason engineers should welcome every opportunity for intelligent leadership, especially during these politically troublesome times. So Calvert Townley, president of the American Institute of Electrical Engineers, told the Milwaukee Society of Engineers last Tuesday at a special meeting held under the auspices of the local section of the institute. Continuing, Mr. Townley spoke of the need for a strong national engineering society and outlined some of the plans which had been suggested for its creation. In this connection it was emphasized that none of the plans contemplated any reduction in the responsibility of local engineering organizations.

Mr. Townley's address was discussed by F.A.Vaughan, consulting engineer of Milwaukee, and Prof. J. C. Pinney, dean of the Engineering College of Marquette University. The latter gave an outline of the extensive activities of Milwaukee engineers in civic problems.

Extension of Rural-Service Lines Gaining in the South

IN A NUMBER of places in the South there is a very noticeable activity in the extension of central-station service into the rural districts. Particular attention, it is reported, is being paid to this class of business by the contractors and jobbers, who persuade six to ten farmers to pay for a new line. As a rule these are 2,200-volt lines and are of inexpensive construction. Owing to the excessive cost of money, it is reported, the Southern utilities, while glad to serve the farmer, have not cared to finance the new rural lines.

Special activity in the extension of lines into the rural districts was noticed in North and South Carolina and in Georgia. Around Memphis and some of the other Southern cities in which the lighting companies are in the hands of receivers increasing service to farmers was not so noticeable.

Expenditure of $1,750,000 Would Save $800,000 Annually

EVER since the disastrous flood caused by seepage from the Cedar Falls (Wash.) reservoir attempts have been made to seal the basin, but the efforts have been unsuccessful. While the first efforts to seal it were made by J. D. Ross, superintendent of the Seattle (municipal) Light and Power Plant, he protested against further attempts of this kind after seeing that the basin could not be made to hold water, and since then the work has been conducted by the water department. Altogether, nearly $400,000 has been spent for sluicing clay into the basin.

Believing that no economical method of sealing can be devised, Mr. Ross purposes abandoning the 110-ft. (33-m.) masonry dam now in existence as an impounder of water and raising the old dam farther up stream so that water in Cedar Lake will be raised to the same level that the temporary spillway of the 110-ft. masonry dam was intended to raise it. This will require an increase in height of only 8 ft. (2.4 m.) at the old dam, which could be made with rockfill from a nearby quarry. An additional 5 ft. (1.5 m.) of water can be stored by installing Tainter gates. This work will cost about $150,000, it is estimated.

In connection with this rehabilitation Mr. Ross proposes cutting an 8,500-ft. (2,550-m.) tunnel from the present tunnel opening at the concrete dam through rock to Cedar Lake itself. The opening of the proposed tunnel would be at such an elevation that 55 ft. (16.5 m.) of water could be drawn down in Cedar Lake, or about 80,000 acre-ft. (98,400,000 cu.m.). This is five times what is now available and would therefore permit a continuous capacity of 18,000 kw. instead of 7,551 kw., the present continuous rating. According to Mr. Ross' figures, based on fifteen years' averages, it would require only 72,000 acre-ft. (88,560,000 cu.m.) to regulate the entire run-off of Cedar River. The tunnel, including headgates, it has been estimated, will cost $1,100,000.

With the transmission and substation labor, machinery and equipment required to complete this development, the total expense would be $1,750,000. However, with this development completed it is anticipated that $800,000 per annum can be saved owing to reduction in fuel-oil consumption at the Seattle steam station, and the investment per kilowatt installed will be reduced from $582.37 to $313.05, even including the abandoned masonry dam and expense of sealing. If the proposed changes are not made, the municipal lighting department will be paying $1,000,000 a year in 1923 for fuel oil alone at the present rate.

Pacific Coast A. I. E. E. Sections to Discuss Transmission

THE Pacific Coast sections of the American Institute of Electrical Engineers will hold a convention at Portland, Ore., in the Multnomah Hotel, July 21 to 24. A tentative program has been arranged as follows:

Wednesday, July 21—Morning address by President Calvert Townley; paper by W. D. Pearslee on "Design and Application of Suspension Insulators." Afternoon, paper by Prof. H. J. Ryan and H. H. Henline on "Unit Voltage Duties in Long Suspension Insulator Strings"; paper by D. M. Jones on "Power-Factor Correction on Distribution Systems."

Thursday, July 22—Morning, paper by R. Beeuwkes on "Electrification of Railroads." Afternoon, paper by Darrat Corbet on "Hogged Fuel, Fuel Oil and Pulverized Coal."

Friday, July 23—Morning, paper by a member of the Pacific Telephone & Telegraph Company on "Bridge Methods for Alternating-Current Measurements"; paper by the chief engineer of the Maryland Pressed Steel Company on "Use of Special Steel in Pressed-Steel Transmission Line Fittings." Afternoon, choice of golf tournament with prize cup offered by J. B. Fisken or trip up Columbia River Highway. Dinner will be served at Crown Point Chalet.

Trips in and around Portland on Saturday will terminate the convention.

Paris to Have 200,000-Kw. Power Station

PLANS have been completed for the construction of a 200,000-kw. power station for Paris, France. This station is intended to replace the small generating plants now operating in the city at a variety of frequencies ranging from 16⅔ to 42 cycles. A site has been chosen on the Seine River close to the city, where the coal supply can be received either by boat or by rail and delivered either direct to crushers or placed in storage.

The main generating equipment consists of seven three-phase, 50-cycle units of 35,000 kw. capacity each at 80 per cent power factor, which feed ten 60,000-volt underground and two 60,000-volt overhead circuits. Turbines will operate at 325 lb. steam pressure with 320 deg. Fahr. superheat. The boiler room will be thoroughly modern in every respect. An additional thermal saving will be effected by using the cooling air from the generators for forced draft.

It is estimated that the plant as designed would have cost $45 per kilowatt of capacity on pre-war conditions. Present cost, it is expected, will be nearly three times that figure. On account of the unfavorable conditions of exchange much of the equipment will be built abroad, although considerable electrical equipment is to be constructed in this country. The design of this plant was discussed by Harold Goodwin, Jr., of the power and mining division of the General Electric Company, at the Washington Section meeting of the American Institute of Electrical Engineers on April 13.

Bare Wire May Supersede Insulated Communication Cables

THE latest researches in uninsulated cable communication conducted by the Signal Corps of the army were revealed by Major-Gen. George O. Squier before the National Academy of Sciences, in session this week in Washington. Multiplex telegraphy and telephony are now possible over open-circuit bare wires laid in or on the earth or submerged in water, according to his report. The expensive, heavy-insulated land and submarine communicating cables will be superseded by a single bare wire submerged in the sea or buried a few inches in the earth, over which a number of telephone or telegraph messages may be sent or received at the same time.

The germ of this plan was noted by Major-General Squier in September, 1910, and discussed by him in April 1912, but it was not until recently that successful tests proved the discovery to be a practical one. Both telegraph and telephone communication was established recently between Fort Washington, Md., and Fort Hunt, Va., distant three-quarters of a mile (1.2 km.), on opposite sides of the Potomac, by the use of a bare No. 12 phosphor-bronze wire laid in the river to connect the stations. The transmitter consisted of an electron tube oscillator which delivered a current of about 270 milliamperes to the line at a frequency of about 600,000 cycles. At the receiving end of the line an electron tube and a six-stage amplifier were used without any ground connection. With this arrangement good tuning was obtained at both ends of the line, and telegraphic and telephonic transmission was secured.

Similar communication was established between two stations at the Signal Corps Laboratory at Camp Alfred Vail, N. J., by using bare No. 16 copper wire buried about 8 in. (20 cm.) in the earth and connecting the stations, about three-quarters of a mile apart. Frequencies as high as 1,000,000 cycles were used. Communication was also carried on by means of a bare wire, one and three-quarter miles (2.8 km.) long, laid on the surface of moist earth. In these land tests a current of about 100 milliamperes was used.

National Organization Conference of Engineering Societies June 3-4

THE joint conference committee of the four founder engineering societies has issued a call to the engineering organizations of the United States for an organizing conference to be held at Washington, D. C., June 3 and 4. It is the purpose of this conference to bring into existence a comprehensive organization which proposes the co-operation of engineering and allied technical associations to further the public welfare wherever technical knowledge and engineering training are involved and to consider matters of common concern to these professions. All engineering organizations whose chief object is the advancement of the knowledge and practice of engineering and the allied technical arts and which are not organized for commercial purposes are expected to send delegates.

A plan of organization has been drawn up by the joint committee based on the following principles:

1. Non-interference with the interrelations with respect to technical matters and the maintenance of the autonomy, functions and operations of individual organizations.
2. Local affiliation of existing groups of engineers in order to facilitate united action in local questions of public welfare and other matters of common interest.
3. National association of engineering organizations by means of National Council composed of representatives widely chosen by local affiliations or organizations and by national organizations, meeting annually and acting through an executive board.
4. Financial support of such association by contributions from all participating organizations on a basis of membership.
5. A form of organization which will permit expansion and development.

Dr. Langmuir Propounds New Conception of Energy and Magnetism

A NEW conception of energy, force, time, space, magnetism and all the general properties of matter was propounded at the Tuesday session of the National Academy of Science at Washington by Dr. Irving Langmuir of the General Electric Company.

To the usual conception of matter involving particles, molecules, atoms and electrons, Dr. Langmuir adds a new division which he has named the "quantel," consisting of a positive and a negative part, present everywhere in space, moving in all directions with the velocity of light and capable of passing through matter. Quantels constitute, according to Dr. Langmuir, what has heretofore been known as the "ether of space" and cause all of the phenonema of light, electricity mass and energy.

Managerial Topics Discussed at Arkansas Convention

THE Arkansas Utilities Association met at Hot Springs the first three days of the week in its thirteenth annual convention. Governor Brough at the opening of the convention stated that the two hundred leading utilities in the state had an investment of $150,000,000 and that the tax commission reports showed that the utilities were fairly reporting their investments. J. S. M. Wharton, president of the association, in responding, said that the records showed that the utilities were paying on a basis of assessment double the average of the other industries of the state.

"Lightning Protection" was the subject of a paper by J. L. Buchanan, president of the Wesco Supply Company, St. Louis. O. P. Barnell, Westinghouse Electric & Manufacturing Company, St. Louis, presented a paper on underfeed stokers. P. W. Thomas, mechanical superintendent Arkansas Light & Power Company, Pine Bluff, discussed the three fuels readily available in Arkansas, namely coal, oil and natural gas, with special reference to labor supply, first cost, reliability, economy and overload requirements. The discussion was merged with that of an address on present operating problems by W. G. Schmauder, Texas Power & Light Company, Dallas, the interesting topics being cost of money, open shop and power plant efficiencies.

A. Hardgrave of Dallas represented the National Electric Light Association, and after due consideration it was voted to affiliate with the Southwestern Geographic Section.

The convention voted to meet at Hot Springs next year. The officers elected for next year are: C. J. Griffith, Little Rock, president; J. F. Christy, Jonesboro, first vice-president; J. A. Whitlow, Pine Bluff,

second vice-president; Judge R. M. Foster, Helena, third vice-president, and S. E. Dillon, Hot Springs, secretary-treasurer.

Water-Power Bill Conferees Reach Agreement

CONFEREES of the Senate and the House on the water-power bill reached an agreement on Wednesday. No public announcement could be obtained from the conferees at that time relative to the changes agreed upon.

The water-power bill has been in conference since the passage of the bill by the Senate on Jan. 15.

Big Spectacle to Be Staged Last Night of N. E. L. A. Convention

THE culminating entertainment feature of the Pasadena N. E. L. A. convention, "La Fiesta de Electra," will take place Friday night, May 21, at the Hotel Maryland. This crowning event will be given by the Pacific Coast Section.

"Charlie" Murray, the Mack Sennett comedian, will be master of ceremonies. He will be assisted by a number of well-known motion-picture performers. In fact, no pains are being spared to make "La Fiesta de Electra" the most spectacular performance of its kind ever staged.

Tentative plans contemplate a dance in the great ballroom of the Hotel Maryland in conjunction with the acts staged by Mr. Murray.

April Financing the Most Expensive Since Beginning of the Year

APRIL shows only a slight decline as compared with March in the total of bond and stock issues offered by electric public utilities and an even higher rate of interest than has appeared so far this year. An issue of three-year gold notes totaling $500,000 offered by the Syracuse Lighting Company is conspicuous because it bears 6 per cent and yields only 6.99 per cent. One of the largest bond issues to be floated by any public utility this year is a five-year note issue for $10,000,000, offered by the Pacific Gas & Electric Company at 97½ to yield 7.70 per cent. With but two other exceptions—a bond issue of the Buffalo General Electric Company for $2,000,000, offered at 97½ to yield 7.60 per cent, and $200,000 in three-year notes of the Massillon Electric & Gas Company yielding 7.60—the yield in every case is 8 per cent or more. All of the issues have short maturities. The bond and note issues total $22,965,000 and represent nine companies. To this is added $10,000,000 in preferred stock of the Ohio Cities Gas Company, bearing 8 per cent interest and offered at par. The following table gives each issue in detail:

Company	Amount of Issue	Period	Class of Security	Rate of Interest	Per Cent Yield	Offered at
United Light & Railways Co.	$ 2,000,000	Two-year	Gold notes	7	8.34	98
Ohio Cities Gas Co.	10,000,000	.....	Preferred stock	8	....	100
Union Electric Light & Power Co.	2,500,000	Three-year	Gold debenture bonds	7	8.1	97½
Syracuse Lighting Co.	500,000	Three-year	Gold notes	6	6.99	97.54
Toledo Traction Light & Power Co.	3,000,000	Three-year	Debenture bonds	7	8.1	97.25
Massillon Electric & Gas Co.	200,000	Three-year	Notes	7	7.6	98.50
Milwaukee Electric Ry. & Lt. Co.	2,000,000	Three-year	Gold notes	7	8.1	97½
Buffalo General Electric Co.	2,000,000	Five-year	Debenture bonds	7	7.6	97.50
Oklahoma Gas & Electric Co.	765,500	.....	Gold notes	7	8	98.72
Pacific Gas & Electric Co.	10,000,000	Five-year	Gold notes	7	7.7	97½
Total	$32,965,500					

Illinois Utilities Say Return Is Not Sufficient to Attract Capital

LEADING public utility operators in the northern part of Illinois told the Public Utility Commission of Illinois at a hearing in Chicago on Thursday of this week that the utilities were not being allowed to earn a sufficient return on their investment to attract capital. It was said to be difficult even to get money at any price to make extensions and betterments which the commission had ordered or which the companies considered necessary. Samuel Insull, president of the Commonwealth Edison Company; B. E. Sunny, president of the Chicago Telephone Company, and Henry A. Blair, president of the Chicago Surface Lines, who appeared on behalf of Chicago utilities, were having trouble in getting necessary capital. The Chicago Association of Commerce appointed a special committee to attend the hearing and a number of municipalities were represented.

Regulation of Utility Labor Receives Attention of Business Men

ONE of the most important questions before the Atlantic City meeting of the United States Chamber of Commerce this week was that of the regulation of public service corporation labor. Up to Thursday morning final action by the chamber had not been taken.

The resolution as first proposed to the Chamber of Commerce came from the Philadelphia Bourse. The wording was probably changed somewhat by the resolution committee before submission to the chamber. The original resolution urged the enactment of federal and state legislation which will declare operating employees of public service corporations to be public servants and as such not free to leave the service simultaneously or proximately so, or at any time except upon due and sufficient notice, and which will also forbid the corporations discontinuing operation by "lockouts" or similar methods. It was held that such legislation should provide for the settlement of all questions concerning wages and working conditions by the representatives of the separate corporations and of the employees of the same, if possible, but that provision should also be made for arbitration (where other methods have failed) before a board upon which the employee, the employer and the public shall be represented. The arbitration should be compulsory and final and provision made for the enforcement of the award or the punishment of either party refusing to accept it.

For the first time the business press of the country has been recognized by the chamber as an integral unit by assigning it a separate session and a place on the general program. James H. McGraw, president McGraw-Hill Company, publishers of ELECTRICAL WORLD, addressed the convention on the function of the business press in relation to production.

Secretary Baker Urges Completion of Muscle Shoals Development

LAST week the Secretary of War appeared before the Senate committee on agriculture to urge the completion of the work on the dam at Muscle Shoals, Ala. The water power should be developed, Secretary Baker declared, even if the nitrate plant should not be operated. He pointed out that the section tributary to Muscle Shoals is particularly in need of the power. Because $7,000,000 has been already expended on the construction of this dam, all of which would be wasted if the project were to be abandoned, Mr. Baker expressed the belief that the only businesslike thing to do is to go ahead with the development. He also urged the operation of the government's nitrate plant.

Frank S. Washburn, president of the American Cyanamid Company, who believes that the government should not attempt the operation of the nitrate plant and should cease work immediately on the dam, made the following statement to the committee:

"It is proposed now to spend $25,000,000 for a 100,000-hp. plant or $250 per horsepower. Let us assume you could use all of it throughout the year and have no losses from idle time. Five per cent on the cost of your power, nothing else, is $12.50 a horsepower. Yet these gentlemen in making their estimates have referred to $1.69 for power in one case and in another case about three times that amount."

Mr. Washburn's estimate of the cost of producing hydro-electric power at Muscle Shoals is as follows:

Administration and labor		$100,000
Maintenance and supply		60,000
Depreciation, obsolescence, insurance and extraordinary repairs:		
Power house, dam and lock		408,900
Equipment		251,500
Contingencies		60,000
Interest, 5 per cent		1,250,000
Steam plant standby:		
Maintenance	$25,000	
Supplies	15,000	
Heat and light	7,500	47,500
Total		$2,177,900
Cost per kilowatt-year		$29.00
Cost per horsepower-year		21.77
Cost per kilowatt-hour		0.0033

Supply Jobbers' Del Monte Convention Plans

PLANS are well shaped up for the Del Monte (Cal.) convention of the Electrical Supply Jobbers' Association, to be held May 12, 13 and 14. Special trains will leave from Eastern points next week.

No program of the association in general has been made available, but it is understood that the Atlantic Division will direct its efforts along these lines: A. M. Little, chairman of this division, will head the discussion on the "Organization Plan of our Electrical Supply Jobbing House." Members will be provided with blueprints showing an organization lay-out. E. W. Rockafellow has been asked to answer the question, "What is going to be the effect on electrical supply jobbers when there is a return to normal times, if that time comes, of the appointment by manufacturers during these abnormal times of many additional distributers?"

Jobbers in the East feel that jobbers in the Central Division and in the Pacific Coast Division do business in a different manner and along different lines from the methods employed in the East. The secretary of the Atlantic Division has invited C. C. Hillis of the Electric Appliance Company, San Francisco, to address the division on the subject of Western methods and F. W. Van Winkle of the Post-Glover Electric Company, Cincinnati, to speak on the way business is done in the Central Division.

Final Action on Uniform Accounting Referred to Committee

AT THE joint conference on uniform classification of utility accounts, held in Chicago April 21 and 22, representatives of the National Electric Light Association and the American Gas Association outlined their classifications of accounts to the representatives of the National Association of Railway and Utility Commissions. The purpose of the conference was to present the views of the two utility associations to the committee appointed by the commissioners' association.

The discussion centered principally on two things—first, the proper method of recording and classifying withdrawals or retirements of units of plant and equipment; second, the proper method of providing through operating expenses for writing off at the time of retirement the book value of the unit retired. On the first question it was agreed by the representatives of the commissioners' association that no benefit results from the requirement now in force in some states that withdrawals be classified with respect to whether installations were made before or after a specified date and that credits for withdrawals of property installed before the specified date be made to one set of accounts and those representing property installed after that date be made to a different set of accounts. It was agreed that both charges for installations and credits for withdrawals made in any given year should be classified and recorded in the same set of detail accounts regardless of date of installation.

With respect to the second question, it was the view of the conferees that provision for retirements of units of plant should be made by charges to operating expenses based on the accounting company's history and experience and other pertinent facts, such charges to be credited to a retirement reserve against which should be charged at the time of retirement the original cost of the units retired less net salvage; and if, because of public policy, obsolescence, inadequacy or other sufficient cause any retirement of an unsual or extraordinary character should become necessary and the loss thereby involved should exceed the balance to the credit of the retirement reserve, such loss, or any portion of it, might, with the consent of the commission having jurisdiction, be charged to a "property abandoned" account to be amortized through future charges to the retirement reserve account.

A sub-committee composed of H. C. Hasbrouck, statistician of the Public Service Commission of the Second District of New York; George C. Mathews, statistician of the Railroad Commission of Wisconsin, and Harry Boggs, accountant of the Public Service Commission of Indiana, was appointed to consider details of the proposed classifications and to report at the earliest practicable date. A set of balance-sheet account titles was worked out and agreed on. All present felt at the conclusion of the two days' conference that much progress had been made.

Hearings on St. Lawrence River Project by International Board

FROM May 7 to June 29 a series of hearings on the projected development of a St. Lawrence River deep waterway from Montreal to Lake Ontario will be held by the International Joint Waterways Commission, representing the governments of the United States and Canada. This scheme provides for an international water route from the Great Lakes through the St. Lawrence River to the sea to accommodate ocean-going vessels. Its projectors wish the United States and Canada to undertake the work jointly. An organization said to embrace fifteen states in the Middle West is promoting the undertaking and it is the object of much favor in the Dominion, but New York State and New York City regard it coldly.

Besides its importance as a transportation project, the scheme has vast significance because of the water power it would make available. There is a total fall in the St. Lawrence River between Lake Ontario and Montreal of about 240 ft. (72 m.).

Representative Nelson of Wisconsin, an ardent advocate of the project, in a recent speech in Congress estimated the cost of a 25-ft. (7.5-m.) channel on the St. Lawrence, exclusive of the additional cost of hydro-electrical development, at $120,000,000. In the Great Lakes drainage basin, he declared, about 1,700,000 hp. could be developed, of which half would belong to the United States.

According to Mr. Nelson, the development of this hydro-electric project would make power so plentiful in New York State that Niagara energy could be released for the benefit of Erie, Pa., and the contiguous territory. A million horsepower, he asserts, could be distributed in an arc extending from Rochester down to Geneva, taking in the whole central area of New York.

The earlier sittings of the international commission are scheduled for the following dates: North Bay, Ont., May 7; Marquette and Sault Ste. Marie, Mich., May 10; Sault Ste. Marie, Ont., May 11; Fort William, Ont., May 13-14; Winnipeg, Man., May 15-16; Grand Forks, N. D., May 18; Regina, Sask., May 20; Calgary, Alta., May 22-24. From there the commission will go to Billings, Mont., holding sittings later in Idaho, Wyoming, Colorado, Nebraska, Iowa, South Dakota, Wisconsin and Ohio, returning to Windsor, Ont., for June 23; London, Ont., June 24; St. Catharines, Ont., June 25; Hamilton, Ont., June 26, and concluding its work at Buffalo, N. Y., June 28 and 29.

Training Course in Welding to Be Developed

DEVELOPMENT of a training course in welding—of which the instructions will be published in circular form—standardization of common welding processes, investigation of welding failures and a determination of their cause, decision on the proper test of welding wire which may be incorporated in specifications, listing and classification of the various processes in which welding is used, analysis of data which will be published on the proper welders to use for various processes and the compilation of a bibliography containing the best papers which have been prepared on welding and the appliances used with it are among the plans outlined for next year by the program committee of the American Welding Society at the annual meeting, April 22.

Establishment of a Philadelphia section of the association was authorized. It was stated that the organization of sections in Chicago and Cleveland was almost complete. The extension of the society into other cities, among which is Detroit, is anticipated soon.

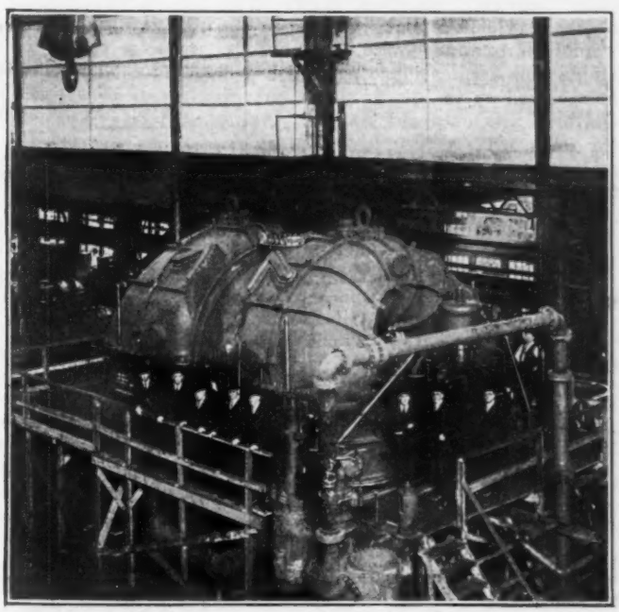
In the election of officers, J. H. Deppler was made president, J. W. Owens vice-president for two years, D. B. Rushmore vice-president for one year. The three-year directors will be W. M. Beard, A. M. Candy, C. J. Holslag, W. J. Jones, C. A. McCune, S. W. Miller, Joan Brogden and P. F. Willis.

A report on the committee for co-operation with the bureau of welding, prepared by H. S. Rawdon but read by Dr. Wittimore, mentioned among other things relative to testing the strength of welds that reports of the Ledebur method of determining the oxygen in iron and steel might be found in the Bureau of Standards library in Technical Paper No. 118 (1919), Scientific Paper No. 350 (1919) and Scientific Paper No. 346 (1919).

In a paper dealing with the speed of arc welding, by William Spraragen, it was stated that a large number of tests showed that with bare wire the electrode should be of a negative polarity except for very thin work; it also showed that a short length of wire is better, and that higher currents than have been commonly used give better results.

Describing the automatic arc-welding machine, H. L. Unland gave figures on speed for definite thicknesses of flat work when working at different current values.

New 60,000-Kw. Unit Turned Over



On April 15 the low-pressure steam unit of a 60,000-kw. turbine-generator for the Duquesne Light Company was officially "turned over" for the first time in the East Pittsburgh shops of the Westinghouse Electric & Manufacturing Company. Among those who were present and who are shown in the photograph are A. W. Thompson, president Philadelphia Company of Pittsburgh, and C. S. Cook, general manager Duquesne Light Company. The members of the party were shown how the turbine is started and how the overspeed governor release prevents it from "running away."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Pennsylvania Engineers Put Duty First.—The annual convention of the Pennsylvania Railroad section of the American Association of Engineers, scheduled for April 17, was postponed on account of the railroad strike, it being felt that the professional engineers employed by the Pennsylvania should be immediately available for any emergency duties that might arise.

Promoting Use of Technical Books.—Among the praiseworthy activities of the American Library Association is that of promoting a larger use of the technical books now in the public libraries and urging employers to install special libraries of technical books in factories and plants for the use of their employees. Edwin A. Goewey, American Library Association, 24 West Thirty-ninth Street, New York, is specially connected with this work.

Examinations for Electrical Draftsmen.—The United States Civil Service Commission announces competitive examinations for electrical draftsmen for the filling of vacancies in the government service. Salaries range from $1,200 to $2,000 a year. Both men and women, if qualified, may enter the examination, applications for which will be received up to July 1, unless enough eligibles are obtained sooner. Apply for form 1312, stating the title of examination desired, to the Civil Service Commission, Washington, D. C., or the secretary of any United States civil service board.

Electricity Supply for Melbourne.—A bill recently passed by the Parliament of Victoria, Australia, and sanctioned by the executive authority, provides for the development of a great electrical plant at the brown-coal mines near Morwell for transmission of energy to the city of Melbourne, 60 miles distant. The first cost of the scheme is placed at £3,000,000. The power plant at Morwell is to contain three turbo-generator sets rated at 25,000 kw. each, with provision for increase of capacity up to 100,000 kw. Transmission is to be at 130,000 volts.

A Westinghouse Record-Breaking Transformer.—The largest single-phase transformer ever built in the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company was recently finished. The transformer is rated at 11,500 kva. and 150,000 volts. It is oil-insulated and water-cooled, has a height of 23 ft. from the base to the tip of the terminal, and when filled with oil it weighs 111,000 lb. To fill the machine 4,700 gal. of oil are needed, and 44 gal. of water a minute are required to cool it. There are 20,400 ft. of wire in the high-tension windings and 17½ tons of iron in the cord. The transformer is one of eleven of the same type built for the Southern California Edison Company.

Electric Motor Installed at Top of Boom.—A Western contracting company has installed a 20-hp. motor on top of a 65-ft. boom which operates the sand and gravel elevator used in unloading barges. When operating at a point where energy cannot be obtained from the shore a gasoline engine drives a 40-hp. motor-generator operating at 1,275 r.p.m., which also furnishes energy for the 15-hp. motor that operates the belt conveyer used to load the elevator buckets. If energy is available, two wires incased in a heavily insulated hose are extended from the source of energy to the switchboard. Both motors are of the Bullock type, compound-wound, 240-volt, direct-current, constant-speed.

Eighty yards of aggregate is elevated in an hour when the motors are run on energy from the generator and 65 yards in an hour when they are operated from the shore.

World's High-Head Hydro-Electric Plants.—A tabulation by E. M. Bergstrom printed in a recent issue of the London *Electrician* lists seventeen representative high-pressure turbine installations made in various parts of the world in the last fifteen years. Of these nine have heads of more than 1,000 ft. The Aura plant, in Norway, ranks first in this respect, with a head of 2,350 ft.; the Tata plant, in Bombay, has 1,650 ft.; the Brusio plant, in Switzerland, has 1,350 ft.; the Necaxa (Mexico) plant and the Mexican Light & Power Company extension plant are tied with 1,279 ft.; the Tysse plant, in Norway, has 1,260 ft.; the Loentch (Switzerland) extension has 1,150 ft. and the original Loentch plant 1,075 ft., while the Kinugawa plant, in Japan, has 1,050 ft. The highest head tabulated for a United States plant is 865 ft. in the case of plant No. 1 of the Southern California Edison Company at Kern River. This is exceeded by two plants in Brazil.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Technology Club.—The Technology Club of Philadelphia is scheduled to meet on Wednesday, May 5.

Michigan Section, N. E. L. A.—This section of the National Electric Light Association will hold its annual convention at Ottawa Beach, Mich., Aug. 24-26.

North Central Geographic Division, N. E. L. A.—The annual convention of this newly organized division of the National Electric Light Association is scheduled for June 16 and 17 at Minneapolis, Minn.

Conference Club.—The first meeting of the Conference Club under its new plan of membership providing representation for the entire industry will be held at White Sulphur Springs, W. Va., on June 17, 18 and 19.

A. I. and S. E. E., Philadelphia Section.—At the May meeting of this section of the Iron and Steel Association, to be held tonight, the program, as previously announced, will be devoted to "general ideas and discussions" on electrical applications in the industry. On Saturday, June 5, the annual outing will take place.

Electric Club of Chicago.—This club announces a "May party" for Tuesday, May 18. At this week's meeting Guy Norton, sales manager of the Duplex Lighting Works of the General Electric Company, discussed the functions and relations of the electrical and illuminating engineer, the electrical supply jobber and the electrical contractor and dealer.

A. E. S. Activities.—A Spokane chapter of the American Association of Engineers was organized on April 3 and a Denver chapter on April 6. A charter for a chapter has been granted to St. Augustine, Fla. The Kansas State College chapter has elected Walter E. Dickerson president, and the University of Missouri chapter has conferred that office on J. W. Moody.

Worcester Section, A.I.E.E., Formed.—A section of the American Institute of Electrical Engineers has been formed at Worcester, Mass., the chairman being C. R. Oliver, construction engineer, New England Power Company, and the secretary D. J. Locke, assistant to Prof. A. S. Richey, Worcester Polytechnic Institute. At the first meeting, held last month, about 100 persons attended, the speaker being Prof. C. F. Harding of Purdue University, whose topic was "The Effect of Power Factor and Load Factor on Central Station Rates."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Powers of State Engineer in Determining Water Rights.—In proceedings for the determination of water rights, the Supreme Court of Nevada has declared, the ultimate findings of the State Engineer, though entitled to great respect, do not under the law take from the district court the power to grant relief to an applicant who takes exception to the State Engineer's decree and whose rights the court may find to have been infringed. (187 P. 1004.)

Liability for Accident Caused by Failure of Light.—Where a company contracted merely to furnish electrical energy for power to the operator of a factory it was not liable, according to the finding of the Mississippi Supreme Court, in Mulligan vs. Meridian Light & Railway Company, for the death of a worker in a factory who, when the lights went out owing to a failure of power, fell into a vat of boiling chemicals, the electric company having no duty toward the employee as agent of his employer or otherwise. (83 So. 816.)

Duty of Commissioner to Make Valuation.—The Supreme Court of Colorado, declaring that the Public Utilities Commission of that State is not a court, bound to consider for determination only what is brought before it, but is a legislative agent with certain administrative duties, has announced that where a public utility seeks increased rates the commission should on its own initiative determine the value of the property devoted to the public use. The court holds that the outstanding capitalization of such company can have but little effect on rate decisions in view of the common practice of watering stock. The commission is not confined to technical rules of procedure and as an investigator it should determine the facts. (187 P. 1082.)

Increase of Rate by Public Utilities Commission Without Valuation Declared Erroneous.—In reversing the action of the Public Utilities Commission of Colorado granting increased rates to the Colorado Power Company for energy supplied to the Ohio & Colorado Smelting & Refining Company, the Supreme Court of Colorado laid down these principles: (1) Where a power company made extensions without having obtained the approval of the commission or a certificate of necessity, it cannot demand an increased rate so as to pay a fair compensation on the property used in the extension, for the state is not necessarily an insurer of the productivity of all investments by a public utility company; (2) the sufficiency of the rate prescribed is strongly presumed, and the burden of showing it to be confiscatory is on the complaining company, there being a still stronger presumption of adequacy where the rate is fixed by contract between the company and third persons; (3) where the commission, without determining the value of the property devoted to public use, entered an order authorizing a power company to charge an increased rate for energy furnished to a particular smelter, which increased rate would probably cause the smelter to suspend operation, such order was erroneous, particularly where it appeared that the same power company supplied energy to a competing smelter in the same state at a rate lower than the one fixed in the contract between the smelter and the power company. (187 P. 1082.)

Electric Supply Company's Responsibility for Death from a Sagging Wire.—Several interesting points were decided by the Missouri Supreme Court in a suit brought by the widow of an employee of a laundry against the Kansas City Light & Power Company for damages because of his death, which was caused by electric shock attributed to a primary wire having sagged and come into contact with a secondary wire which energized a defective drop cord feeding a lamp. The question of the company's negligence was held to be one for the jury. The negligence of deceased's employer in not furnishing a properly insulated drop cord did not relieve the company from liability for the accident, the proximate cause of which was its own negligence, even though the fatality might not have taken place had the drop cord been intact. A requested instruction to the jury that the plaintiff could not recover if the deceased knew that the lamp cord was defective or in such condition that he was liable to receive a shock from it was properly refused, as was a further requested instruction that defendant was not liable if it had constructed and maintained wires in the manner required by the electrical department of the city. Testimony from men of long experience in electrical work that they had felt the passage through their own bodies of the voltage normally carried by secondary wires and had seen deaths from higher voltage, and expert testimony as to whether an electric supply company was negligent in permitting a primary wire to sag and touch a secondary wire, were properly admitted, but evidence as to the condition of the wires three years before the accident and two years after the accident was inadmissible in the absence of a showing as to the condition of the wires in the interval. The court also held that a verdict for $10,000 in the case of a widow with three children under seven years whose husband was twenty-nine years old at the time of the fatal accident and earned $22.50 a week was not excessive. (219 S.W. 80.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Donations Not a Proper Charge to Operating Expenses.—Donations made by public utilities for patriotic and other purposes must not be charged against consumers as an operating expense, the Missouri Public Service Commission has held, but are to be understood as the contributions of the stockholders.

Outside Business of Municipal Plant.—When a municipality furnishes service beyond its own limits it becomes a public utility, the Colorado Public Utilities Commission holds, and is subject to the jurisdiction of the commission, and the commission will not refuse to assert authority over rates in such cases on the ground that the municipality has no constitutional or statutory power to supply customers beyond its bounds.

Reasonable Rates to Street Railways.—Where an electric power company furnishes electrical energy under contract to a street-railway company at actual cost plus 25 per cent to cover loss in transmission, and in consideration thereof the railway company supplies and maintains the transmission lines used in serving it, the rate, according to a decision of the Public Service Commission of Pennsylvania in a complaint brought against the Northwestern Electric Service Company, is not unreasonable, because the increased costs of energy and transmission, so far as service to the railway is concerned, are actually reflected in the rate paid by the railway company and do not fall upon any other class of consumers served by respondent.

Relations of Producing and Distributing Companies.—To a petition of the city of Aledo, Ill., against the Illinois Northern Utilities Company, charging inadequate service, that company replied alleging that the poor service was due to the failure of the Edwards River Power Company to supply it with power and asking that the latter company be made a party to the proceedings. The Illinois Public Utilities Commission decided that the producing company is not a necessary party to a complaint against the service of a distributing company. The commission, while ordering the distributing company to improve its service, found that the question whether a public utility has violated its franchise by raising rates or rendering nadequate service is not within its jurisdiction and also that it has no power to issue an order for the enforcement of a court injunction.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

H. C. Orton is now general manager of the Interstate Power Company, with headquarters at McGregor, Iowa.

W. H. Burtis, who was general manager of the Interstate Power Company, Decorah, Iowa, has been made general manager of the South Dakota Light & Power Company, Armour, S. D.

D. George McMillan has resigned as superintendent of power with the Singer Manufacturing Company of Elizabeth, N. J., to accept the position of maintenance engineer with the Williams Printing Company of New York City.

Edward F. Flynn, of Stone & Webster, formerly assistant to Henry Howard, who was director of the United States Shipping Board recruiting service during the war, was presented with a loving cup recently by the personnel of that service.

Charles T. Main has recently enlarged the scope of the engineering work of his office to include textile mills and other industrial plants, water-power and steam-power developments and examining and reporting on plants. Col. F. M. Gunby, who has recently been released as head of the engineering branch of the construction division of the United States Army, has returned to take up the work of engineering manager of Mr. Main's organization.

Prof. William H. Freedman, for many years the head of the electrical department of the College of Engineering at the University of Vermont, has resigned to become head of the department of personnel and training of the American Telegraph & Telephone Company. This is a new department of the company. Professor Freedman expects to make his headquarters in New York City. He will not entirely sever his relations with the university, but will give lectures each year.

W. G. Claytor, who has recently been appointed assistant to the general manager of the Roanoke (Va.) Railway & Electric Company and the Lynchburg (Va.) Traction & Light Company, was formerly general superintendent of the lighting and power departments of those companies. Mr. Claytor entered the service of the companies in January, 1907. During the war he served in the United States Army with the commission of captain as electrical engineer for the United States Pieric Acid Company, Brunswick, Ga.

George B. Tripp, president of the Central Construction Corporation of Harrisburg, Pa., has resigned to take up the duties of vice-president and general manager of the South Carolina Light, Power & Railways Company at Spartanburg, S. C. The latter company operates hydro-electric steam and gas plants as well as an electric railway system in Spartanburg and suburban territory. Mr. Tripp succeeds F. H. Knox, who was recently elected president of the Columbia (S. C.) Railway, Gas & Electric Company, as was mentioned in these columns in the issue of Feb. 28.

Warren B. Lewis, who took over general supervision of the Taunton (Mass.) municipal lighting plant in 1919, has now turned the plant back to a local manager after making the necessary improvements to increase its efficiency. George F. Seibel has been appointed resident manager in charge of this plant. Mr. Lewis has for more than twenty-five years maintained a consulting engineering office at Providence, R. I.

R. W. Alexander, manager of the stock sales department of the San Joaquin Light & Power Company of Fresno, Cal., returned to that city on May 1, after a ten days' visit in Eastern financial centers. He also accompanied A. Emory Wishon, assistant general manager of the company and president of the Pacific Coast Section of the N. E. L. A., during a speaking tour of the East undertaken by Mr. Wishon to outline his self-interest idea in the financing of needed central-station development. Features of the plan and its co-operative possibilities are outlined on page 997 of this issue. Mr. Alexander is largely responsible for the execution of the company's stock-selling campaigns, outlined on page 959 of the April 24 issue of the ELECTRICAL WORLD.

R. W. ALEXANDER

Frank V. Magalhaes, who has recently been made superintendent of meter and test departments of the New York Edison Company, has been a member of the engineering department in various capacities since 1898, with the exception of leaves of absence to attend Pratt Institute and the Brooklyn Polytechnic Institute. After graduation from the latter institution in 1906 with the degree of electrical engineer, he became foreman of the company and in 1907 was transferred to the meter department as general foreman. In 1910 he became superintendent of the meter department and in 1917 was transferred to a similar position in the test department. His appointment as superintendent of both the meter and test departments is in recognition of the able work he has done.

Obituary

John Graves Phillips, who for a number of years held the position of sales representative in Philadelphia for Harvey Hubbell, Inc., died at his home in Elkins Park, Philadelphia, on March 31.

Henry P. Erwin, treasurer of the Brooklyn Edison Company and for many years prominent in Republican politics of his district, died on April 24 in Brooklyn, N. Y., at the age of forty-two years.

William A. Lincoln, treasurer of the United Electric Light Company, Springfield, Mass., died at Springfield, April 22, aged sixty-two. Mr. Lincoln was president of the Springfield Safe Deposit & Trust Company and was one of the best known bankers in western Massachusetts.

Frank E. Hurlbut, Brooklyn (N. Y.) representative of the Parr Electric Company, New York, died suddenly on April 1. Mr. Hurlbut was electrical inspector for the New York Board of Fire Underwriters for fourteen years in New York and Brooklyn and was widely known among contractors.

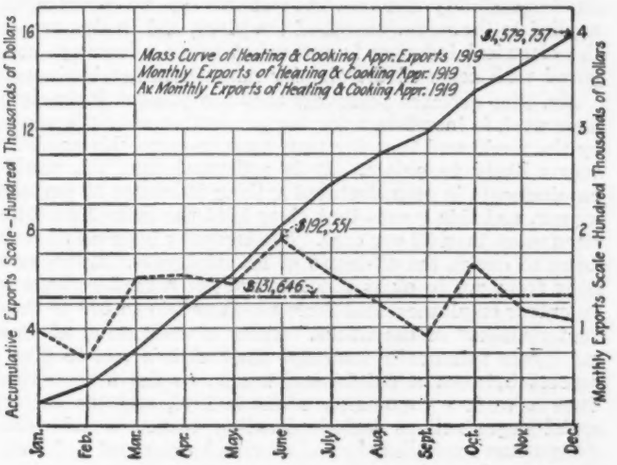
Col. John Bogart, the well-known consulting engineer, who died at his home in New York City, April 25, had been associated with many prominent civil-engineering projects throughout the United States. During the civil war he worked on the fortification at Fort Monroe and other points. Subsequently he held the following positions among many others: Chief engineer of the Park Department of New York for six years, New York State Engineer for four years, constructing engineer of the Washington Bridge, New York; chief engineer of the Rapid Transit Commission, designer of railroad terminals for Buffalo and Toronto. He was employed as an expert on harbor works in South America, especially the harbors of Venezuela. He had also served as consulting engineer for a number of large water-power projects, including developments at Niagara Falls, Keokuk, Iowa, and Chattanooga, Tenn. For the New York Edison Company he also acted in consulting capacity on the building of its large steam stations. Colonel Bogart was eighty-four years old when he died and still maintained his office at 29 Broadway, New York City.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Analysis of 1919 Electric Heating and Cooking Apparatus

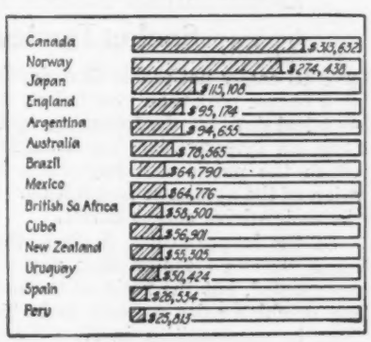
THE value of electric heating and cooking apparatus exported from the United States during 1919 ranked twelfth as regards classes of electrical apparatus exported, last year's exports of this product amounting to $1,579,797. The exportation of heating and cooking apparatus was very uniform throughout the year, as is indicated by Fig. 1. The highest monthly value was recorded



MONTHLY VARIATIONS OF EXPORTS

in June, amounting to $192,551. The average monthly rate of exportation was $131,646.

Data compiled by the ELECTRICAL WORLD indicate that Canada imported the largest amount of electric heating and cooking apparatus, being followed closely by Norway. These two countries stand in a class by themselves as regards this class of imports, Japan, the third in rank, being over $159,000 behind Norway. Fig. 2 shows the relative value of exports to various countries importing heating and cooking apparatus, the value of which was in excess of $25,000. It is noticeable that with the exception of England not a single European nation involved in the late war imported more than $25,000 worth of this class of electrical apparatus. The market in these countries, however, appeared to be opening up during the latter part of the year, owing mainly to more normal conditions.



ANALYSIS OF EXPORTS BY COUNTRIES

The six progressive American republics of Argentina, Brazil, Mexico, Cuba, Uruguay and Peru absorbed about $358,000 worth of this apparatus, or more than was taken by Canada. The housewives in the larger cities of Argentina and Brazil are especially attracted by these convenient electrical devices for the home, and the native merchants are pushing the trade in every way possible. Australia and New Zealand have a large proportion of people who can afford to live well, and the importation and sale of small household electric apparatus is of considerable proportions in these countries. The total imports of heating and cooking apparatus from the United States by these two island commonwealths was $133,870.

Especially noticeable is the fact that the export of this class of electrical apparatus in large quantities is confined to the countries where the benefits of electricity have become recognized by the inhabitants, or where the people have not been reduced by the ravages of war to the use of the more primitive methods of heating and cooking with wood. The inhabitants of such countries as China and British India, both of which imported large amounts of insulated wire and motors in 1919, have not as yet come to recognize the benefits of electricity as a heating agent, but are still marveling over its more fundamental uses, for illumination and power.

The above figures are based on export statistics issued by the Bureau of Domestic and Foreign Commerce for 1919.

Freight Situation Beginning to Be Unscrambled

RAILWAY transportation conditions have improved during the past week. Several Eastern railroads have lifted their freight embargoes on carload-lot shipments to an extent, but at this writing there is little new nonperishable freight moving. Here and there jobbers and manufacturers report a carload of electrical material received. In most cases, probably, it has been released in the first general unscrambling of cars in the freight yards. Railroad labor has returned rather rapidly in the last few days, and it is expected that by the end of this present week the movement of pent-up cars will be noticeable. It will undoubtedly take two full weeks to accomplish anything like a fair clean-up of the yards, and in the meantime a small amount of new freight will have been moved.

There has been almost no movement of steel strip this week so the output of flexible armored conductor has been negligible. Trucking of this material has been continued, but the movement has not begun to fill the demand. Few jobbers report any stocks of armored conductor, although a few belated cars have been located and moved to unloading points. An advance of $8 per 1,000 ft. has been applied to this material as of date of April 21.

Rigid-conduit production has likewise been negligible and, with the exception of a car found here and there, little has found its way to jobbers' stocks. Steel-mill production is badly curtailed, many furnaces having been blown out for lack of raw materials, coke, etc. The mills have been running as far as they could and finished products have been piled high in warehouses. This end of the electrical trade will probably feel the effects of the strike longest as the volume of steel, finished and semi-finished, waiting for shipment is large, and it will take many weeks to move it. Added to freight congestion is the car shortage and locomotive shortage.

In the New York City district auto-trucking across the rivers and to the piers has been unsatisfactory. So many houses are attempting to move materials by this method that whole days are lost in awaiting turn to board boats or

unload at piers, and many trucks have returned to their starting points loaded. Cartage of lamps from the factories in this neighborhood to nearby points has fallen because of blocked traffic. Stocks of lamps are increasing in Harrison and Bloomfield plants, and at the same time supply of raw materials is almost shut off. A break in this raw material situation is expected soon.

New England routes are still open to New York and points south. Schedule materials are being trucked to New York City, the trucks going to Trenton for porcelain before returning to Connecticut mills. Rubber-covered wire and heating appliances continue to be received by jobbers by this method.

The situation is creating a bad collection record for the month. Some manufacturers have required payment on goods held up for weeks, and jobbers who have complied have had little or no return on their money because of their inability to ship and bill. Unless shipments permit jobbers to move some of their short stocks this week, billings for the month of April are going to be much below the average.

Rubber and Wood Parts Hold Up Battery Production

THE demand for starting and lighting storage batteries is so far in excess of the available capacity of leading battery manufacturers that shipments are being delayed because of short supply of raw and semi-finished parts. Battery manufacturers increased their capacity for this year's business to an extent which they thought would be sufficient to handle the demand and are now finding that they undershot the mark by about 30 per cent. Consequently new increases in floor space are well under way in several plants.

Outside of the present transportation upset, there has not been enough rolling stock to handle raw materials into the mills or finished and semi-finished products away from them, and therefore the battery manufacturers have not been getting all the parts they need. Rubber-jar manufacturers have not been able to supply the demand for jars even with old-line rubber manufacturers getting into the jar field. A serious shortage is being felt in the line of wooden parts. Separators are not being turned out in quantities great enough to satisfy the demand, and wooden boxes to hold the finished battery are not so plentiful as they should be. Wood packing materials for shipping are getting scarcer, and increasing costs of packing are being tacked on to final battery costs. Lead for grids and connectors and sealing compounds seem to be sufficiently plentiful to have no detrimental effect on shipping schedules. There is, however, no excess supply of acid tank cars, and there is a possibility of a hold-up here and there through failure of acid to show up on time.

Battery manufacturers are looking for even greater business in the next few years. At the present rate of automobile prduction, and that anticipated up to 1925, ou ut of starting and lighting batteries alone will have to be considerably increased everywhere merely to meet the demand. New companies are entering the manufacturing field almost daily, it seems, but will not be in a position for some time to take big slices of the battery business. Many of them are merely assemblers of parts and depend on the larger companies, which are already well loaded down, for their materials.

The demand for storage batteries for special work is increasing, but is not what the larger manufacturers call attractive business. They are already so heavily booked on starting and lighting batteries, which they are turning out under heavy quantity production, that they are not anxious to turn even part of their capacity over to special work. Special work takes greater engineering skill and often necessitates adding to the personnel, and some manufacturers do not feel they would be justified in thus increasing their forces. Besides, they feel that they have all they can take care of in their present high volume of simply executed orders. Consequently it seems that there might be a place in the industry for manufacturers of storage batteries for special purposes.

Sell Square Deal to Labor to Help Solve Difficulties

ALTHOUGH he had no panacea to offer on the labor problem, Richard H. Rice, manager of the Lynn Works of the General Electric Company, recently stated that he thought a long step forward could be taken toward the solution of many of the difficulties confronting industry if the idea of the square deal were sold to the employee.

In discussing the situation, Mr. Rice says that there are thirty-seven nationalities and fifty different classes of apparatus represented in the manufacturing field with which he is in touch; that the demand for electrical products is so great that orders are being turned away, and that the housing problem today limits the expansion of the company's man-power. The need of both quality and quantity production is paramount. The union spirit, with its tendency toward limiting production and minimizing of interest in work, is unfavorable in its effects, and a tremendous amount of educational effort must be expended in order to counteract such tendencies in many establishments. The complexities of electrical manufacturing are so great that it is obviously an impossibility for soviet methods to be successfully applied to the management of the plant, and in this respect the electrical industry is somewhat at an advantage compared with some of the simpler manufacturing businesses.

Mr. Rice declares positively that the present forty-eight-hour week is insufficient for the production of goods needed by the world and that for some time to come this condition seems likely to obtain. It is estimated that the world's requirements in manufactured articles increases 10 per cent a year, and this means that since 1914 the annual need has risen more than 50 per cent. His company is doing much at Lynn to enrich the off-hours of its employees. Every noon hour from six to eight concerts are given in the shops by volunteer employees, and there are from 200 to 300 of these "entertainers" in the works. Twice a week some of these employees voluntarily interrupt their night's rest to give a concert between midnight and 1 a.m. to the night shifts. Once a week a community night is held, and the factory social organizations include bowling teams, a rifle club, gymnasium for both men and women, boxing and ball clubs. There are classes in reading music at sight, French, English, civil government, an American Institute of Electrical Engineers Lynn section of 800 members, and classes in Americanization. Recently the company took sixty of its foreign-born employees to Salem, where they were sworn in as American citizens and welcomed into the brotherhood of democracy. There are training conferences for foremen, which, Mr. Rice says, are most helpful in improving relations with subordinate employees and in bettering preparation for department headship.

Department Stores Big Factor in Socket Device Sales

IT IS easily noticeable that department stores are taking a bigger part than ever before in the distribution of electrical devices. In following up this matter in New York City, an investigation has brought out the readiness with which the public will buy when it understands the operation of the appliance in question. This is especially true of the motor-drive socket device.

Of the larger socket devices, the department store sells more vacuum cleaners than any other device. This is not unexpected, but the ratio of vacuum cleaner sales to washing machine sales appears to be higher in New York City than in communities in New England, the West and the Middle West. This is undoubtedly because of the small space available in the average New York apartment kitchen for a machine of this size. Then, too, many people who otherwise would have a machine live in hotels.

The dishwasher and the mangle are the least well known of these socket devices. The public has had little acquaintance with them, but the department stores are increasing in number where sales of these machines are carried on.

It is rapidly being realized that, already having the housewife in the store for other purchases, a reasonable amount of sales effort and demonstration will create an interest that will be difficult to down. Only five or six department stores in New York City carry electric dish washers and mangles, although washing machines and vacuum cleaners may be found in a dozen or fifteen of them. They do not necessarily specialize in just one make of machine, but may carry up to four or five makes of vacuum cleaners and a couple of washing machines.

In only two stores have manufacturers placed the operation of their vacuum cleaners and washing machines in charge of their own representatives, and it is interesting to note that in these two cases the sales have far exceeded those of the stores where this policy has not been followed. Extremely large orders have been placed with the factories concerned in order to attempt to provide sufficient stocks for the demand created. It is noticeable even in some large department stores that where there is little effort placed on selling and no demonstrations are made the sales of vacuum cleaners will average only two a day. Compared with an average of 190 a month in one store, the value of demonstrations is obvious. Some few stores also follow up sales in order to insure correct utilization in the home.

Advertising, not only on the part of the individual store but also by the manufacturer, is bringing increased sales, because repeated instances show that prospective customers are coming to the store to inquire after a definite make of machine.

Metal Market Situation

IN THE domestic market copper is developing a little stronger tone. There has been no general dropping off of price either on the part of producers or of the outside market, although some small sales were made at 18.50 cents at refinery. Producers' prices for the present quarter are steady at 19.25 cents and third quarter at 19.75 cents. For this later delivery bids were a quarter cent under this figure. The inquiries in both markets are greater than during the past week, but sales are light.

Export demand is holding up well in face of shipping and exchange conditions, and it is expected that the month's total will show fair figures. Plans are taking form for extending credits to French copper consumers, and under tentative arrangements credits running from 90 to 120 days are proposed.

Reports from Butte, Mont., show less than one-third normal crews of miners at work in copper mines. Last week the works closed entirely as a result of the strike. Copper production in general is at a much lower rate than it was a year or so ago. The heavy buying, both domestic and foreign, of the past six months has reduced any accumulated stocks to such an extent that in some leading quarters it is expected that by midsummer these stocks will be so small that they will have considerable tendency to move prices upward.

Brass mills in New England are running short of raw copper and strike conditions are affecting some of them.

NEW YORK METAL MARKET PRICES

	April 21			April 28		
Copper	£	s	d	£	s	d
London, standard spot	104	10	0	103	0	0
	Cents per Pound			Cents per Pound		
Prime Lake	19.00			19.00		
Electrolytic	19.25			19.25		
Casting	18.37½			18.37½		
Wire base	23.00			23.00		
Lead, trust price	9.25			9.25		
Antimony	10.50			10.25		
Nickel, ingot	43.00			43.00		
Sheet zinc, f.o.b. smelter	12.50			12.50		
Zinc, spot	8.35			8.20		
Tin	61.50			61.50		
Aluminum, 98 to 99 per cent	33.00			33.00		

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	16.50 to 17.00	16.50 to 16.75
Brass, heavy	10.25 to 10.50	10.25 to 10.50
Brass, light	9.00 to 9.50	9.00 to 9.50
Lead, heavy	7.50 to 7.50½	7.25 to 7.50
Zinc, old scrap	5.00 to 5.25	5.00 to 5.25

THE WEEK
IN TRADE

SHIPMENTS are gradually improving and materials are being received slowly but surely in nearly all sections of the country. The amounts received by truck and by rail, however, are slight in comparison with the demand, and although materials were coming in quite satisfactorily up to the time of the railroad tie-up the heavy spring building operations promise to clean out jobbers' stocks entirely and to cause a serious delay to the building program unless much needed material is received. Labor conditions in the building trades in New York and in Atlanta appear much brigter than heretofore. Building materials, non-electrical, are scarce in the East and may cause some work to be delayed. Weather conditions in the South are discouraging as the heavy rains are delaying spring planting. In Chicago heavy demand continues, and it is expected that April sales will be as large as those for March. New England jobbers have been greatly benefited by the inability of manufacturers there to ship their products out of the district. Many back orders have been filled. Labor conditions in the Naugatuck Valley are unsettled. The volume of business done in Boston has been about normal. In the West activity in the building trades will continue for months to come, and although there are some signs of retrenchment in retail lines, volume of business is considered fair.

NEW YORK

Considerable improvement in shipments is noticeable in the metropolitan district, although it is far from satisfactory, and in some instances jobbers are completely out of a large number of stocks and certain manufacturers have been forced to cut their production. This is true of manufacturers of outlet boxes and flexible armored conductor.

Lamps, glassware, porcelain, heating appliances, irons and sockets have been received in quantities by truck. Some freight has been located and unloaded, including a number of shipments of flexible armored conductor, rubber-covered wire, condulets from up-state, miscellaneous material from Schenectady and some schedule material.

Demand for roughing materials, including pipe, wire, etc., has improved, and much business will be transacted during the next four weeks provided that jobbers can get shipments long overdue.

Flexible armored conductor has advanced $8 per 1,000 ft., and metal molding approximately 5 per cent.

Flexible Armored Conductor.—Stocks generally are low or have completely vanished. Shipments are coming in, however, and a number of jobbers have received quantities of from 5,000 ft. to a carload. One jobber has just unloaded 10,000 ft.; another has received one carload, which was due here in March, and others report the receipt of varying quantities. The total amount received is not large but is encouraging. Prices are up about $8 per 1,000 ft. One jobber is now quoting No. 14 double-strip at $120 per 1,000 ft. in quantity, $131 per coil or $150 for less than a coil.

Metal Molding.—Stocks are low and in many instances are completely out. Shipping delays have held up both raw material and the manufactured product. Demand is many times the supply. The National Metal Molding Company has doubled the list price, thus getting away from plus discounts. Some price revisions have been made amounting to approximately a 5 per cent increase.

Glassware.—Demand has increased during the week. Good stocks are on hand and shipments are commencing to come in, two jobbers having received some within the last few days.

Heating Appliances.—Toasters, irons and heaters are coming in better. At the same time, the demand has eased off a little.

Ranges.—Some ranges have come in, but these are cornered by orders and are shipped out as soon as received. With the exception of ranges still to be delivered, there will be few in the market until fall.

Heating Appliances.—As of April 10, discounts on Westinghouse heating appliances in broken packages to dealers decreased five points. The 3-lb. iron went from $6.50 to $8.50, the 8-lb. iron from $8.50 to $9.50, the five-cup percolator from $14.50 to $15, and the turnover toaster from $7.50 to $8.50.

Apparatus.—A 5 per cent increase in price was effective about April 12 on Westinghouse large-size engine-driven generators, frequency changers, rotary convertors, motor-generators, water-cooled and self-cooled transformers.

Lamps.—Stocks are spotty. Few lamps have come in to jobbers' stocks this week and supplies are low. One jobber reports receiving several truck loads of lamps from Massachusetts.

CHICAGO

Regardless of reports of almost complete return to normal, shipping conditions so far as electrical manufacturers and jobbers are concerned are still bad. Almost complete cessation of freight receipts have swept jobbers' shelves bare, and inability to make shipments is piling manufacturers' warehouses full of merchandise which is badly needed throughout the country. Announcement this week of the lifting of the long-continued embargo on express consignments has helped to a certain degree.

Bad as this combination of circumstances seems, it has not tended to decrease the steady flow of orders and inquiries. Indications are that April business will be virtually as large as March.

Collections are subject to three factors, viz., time consumed in securing goods in transit, inability of factories to ship manufactured products and general reluctance of banks to make or renew loans. Collections are materially slower than before. Large interests report current liquidation of bills to be generally under pressure.

Weatherproof Wire.—Constant heavy production has enabled dealers to obtain deliveries on all sizes in from four to six weeks. Changes in copper prices of three weeks ago have put weatherproof wire up to a 28-cent base. Chicago prices are: On No. 6, 30 cents; on No. 8, 31 cents, and on No. 12, 34 cents per pound in lots of 500 lb.

Bare Copper Wire.—Recent slight reductions in the market price of electrolytic copper have been sufficient to change wire prices in effect for the past three weeks. Supply and demand both remain constant with delivery in from six to ten days.

Outdoor Lighting Equipment.—Demand from public utilities and municipalities is strong. Suspension street hoods are a prominent feature. With an 18-in. radial-bowl reflector these are quoted for immediate delivery at $11.65 each, complete.

Pole-Line Equipment.—Conditions remain about the same as for some time past. Heavy demand is felt for material for farm-line transmission.

Fuses.—Current quotations on non-renewable cartridge fuses are as follows: 1 amp. to 30 amp., 25 cents each, subject to 42 per cent discount in standard packages, 23 per cent in fifths and 12 per cent in less than fifths; 35 amp. to 60 amp. are 35 cents each, with the same quantity discounts. Refillable cartridge fuses are, for 1 amp. to 30 amp. in standard package, $23.85 per 100; in fifths, $28.05 per 100; in less than fifths, $47.55 per 100; 35 amp. to 600 amp., in similar quantities, are priced at $47.25, $59.25 and $94.25 per 100.

Buzzers.—Resulting from increased production costs, buzzers have been advanced approximately 10 per cent. Present prices are, in lots of ten, class B, 65 cents each; class C, 60 cents each. Delivery can be made from jobbers' stock.

Circuit Breakers.—New list prices are now in force on the I T E line of circuit breakers made by the Cutter Electrical & Manufacturing Company. The advance on this line is about 10 per cent instead of 50 per cent, as was erroneously reported in these columns on April 3.

BOSTON

No let-up is apparent in the volume of trade, notwithstanding the chaotic condition of deliveries. Collections are holding up well, but jobbers are handicapped in some cases by the insistence of manufacturers upon payments before the receipt of goods in transit. Stocks are very uneven, and steel supplies are very low. Porcelain from outside New England is scarce. Prices are being maintained steadily as a whole, but some weakness is noted in rubber-covered wire. The inability of not a few manufacturers to ship normal consignments out of New England during the period of recovery from the effects of the railroad strike has helped local jobbers wonderfully in filling back orders. Motor-truck shipments continue to give some relief to Boston and other cities distributing electrical supplies, and parcel-post deliveries are working out well in this district for smaller material. Labor conditions are somewhat unsettled, especially in the Naugatuck Valley, where production in brass works has been greatly curtailed by a strike of unskilled workers.

Wire.—Rubber-covered wire quotations show softness this week. One price as low as $11 per 1,000 ft. on a 5,000-ft. lot basis was seen a few days ago, and $11.50 to $12 is being asked in other cases. Stocks are in good shape.

Non-Metallic Flexible Conduit.—Stocks are spotty. One jobber succeeded in filling all his orders and had some loom to sell to competitiors at the end of last week through shipments received from a New England factory which was unable to ship its product West and South. Other inquiries brought report of zero stocks in this material. Prices are firm at $37 per 1,000 ft. for $\frac{7}{32}$-in. and $40 for $\frac{1}{4}$-in. loom.

Flexible Armored Conductor.—Stocks are being temporarily built up here and there with the aid of motor-truck shipments. Prices are very firm, No. 14 single-strip is quoted $110 per 1,000 ft. and double-strip of this size at about $125.

Sockets.—A plentiful supply still features the market, with steady prices. In case lots, pulls bring 50 cents, keys 28 cents and keyless 26 cents.

Rigid Conduit.—Deliveries are greatly upset. Stocks of $\frac{1}{2}$-in. and $\frac{3}{4}$-in. pipe are shot to pieces, only dribbling sales being reported. Galvanized pipe, $\frac{1}{2}$-in., brings $99.58 per 1,000 ft. in less than 2,500-ft. lots, and $\frac{3}{4}$-in., $132.20. Black pipe in these sizes is quoted at $93.98 and $124.60 respectively. One representative jobber had no pipe, either white or black, under $1\frac{1}{2}$-in. size Monday. Quotations on 3-in. galvanized and black conduit were $879.37 and $828.90.

Lamp Cord.—Cotton-covered cord is now in fair supply, No. 18 bringing $30 per 1,000 ft.

Motors.—Deliveries are being extended to from twenty-eight to thirty weeks on motors of 5-hp. to 20-hp. rating. Prices are steady and the demand is extremely active. Manufacturers are making vigorous efforts to increase their production facilities.

Appliances.—Washers are moving freely, although some difficulty is being encountered on shipments from outside New England unless by boat. Cleaners are in heavy demand. Heating devices are reported scarcer in some jobbing circles.

Meters.—Business is holding up vigorously. Gradually manufacturers appear to be getting into a stride which promises fairly good deliveries for some time. Central-station storerooms are not carrying many extra meters, but the present needs of the market are being pretty well handled. Fairly good shipments for immediate needs can be made on the basis of about three to four weeks' delivery.

Lamps.—Regular customers' needs are being met by manufacturers with reasonably good success, but shipments are being held down to clear requirements. A shortage is reported in 40-watt "B" lamps. Miniature and sign lamps are in good supply.

ATLANTA

Jobbers are beginning to feel keenly the effect of the railroad strike in the East, particularly on express shipments, of which only few are coming through. One or two firms report a slight slowing up in the contractor demand because of the local strike, but the outlook for a settlement of the controversy with the carpenters' union, which was scheduled to go out on May 1, is somewhat brighter and a number of jobbers are predicting that the strike will not take place.

Collections from contractor-dealers show some improvement, but payment of accounts by automobile accessory houses and other lines of business which are not wholly of an electrical nature are reported not altogether satisfactory.

Weather conditions throughout the territory are discouraging from an agricultural standpoint, and unless rains cease crops will be curtailed because of late planting.

Fans.—The fan season opened up well, with the prospect that the demand will exhaust local stocks. However, there is a plentiful supply of desk fans on hand at present.

Sewing Machines.—Spring has stirred this specialty into activity and stocks are moving briskly. A good supply of machines is in the territory, but slow shipments, on account of difficulty in obtaining proper woodwork, will soon deplete local holdings.

Wire.—The wire outlook is not so bright as heretofore, stocks of No. 12 being practically exhausted, while the popular sizes of weatherproof are hard to obtain in quantity. It is difficult to accumulate any stocks in the face of the strong demand.

Porcelain.—Porcelain stocks show no improvement over last week, although one jobber reports the receipt of a large shipment of knobs, insufficient, however, to afford more than temporary relief. Manufacturers will make no promise of shipment. Prices—Knobs, 500 to 4,000, $3.10 per 100; cleats, 300 to 1,850, $3.20 per 100.

Heating Devices.—Stocks of hollow ware are low and shipments unsatisfactory. There is a sufficient supply of flatirons in the territory.

Line Material.—A fair supply of line material is reported, hardware excepted. One of the largest jobbers reports the receipt of a large shipment of cross-arms, relieving a shortage that has existed for several weeks. Shipments on poles are reported satisfactory. Price, cross-arms, pine, four-pin, 5-ft., less than 1,000 ft., $1.23.

Glassware.—There is a shortage in glassware. Such stocks as are in the territory are reported very spotty and consist mostly of obsolete material. Little hope is held out for improvement in the immediate future.

Vacuum Cleaners.—National and local advertising has greatly stimulated the movement of this device. Stocks at present in fair condition are being rapidly depleted, while best shipments are quoted at three months.

Armored Conductor.—The supply received by one jobber ten days ago was quickly exhausted and the local situation is again acute, there being no stocks of moment in the territory. Only indefinite promises of shipment are being made. Price, 1,000 ft. to 2,500 ft., $11.60 per 100 ft.

Washing Machines.—The demand indicates that this article is growing in popularity and difficulty is being experienced in taking care of the trade. While stocks are in fair shape they will be quickly exhausted unless the embargo on shipments is lifted.

SEATTLE—PORTLAND

In Seattle jobbers and dealers report business during the past week as featured by movement of schedule materials, fractional-size motors and farm-lighting plants and by the decrease in sales of labor-saving devices for the first time in months. Inquiries and actual sales were considerably decreased. Stocks in every line are short, and the outlook for future deliveries is far from promising. While prices on some lines, principally scheduled material, are fluctuating, there has been no material increase. Business building in Seattle and contiguous Puget Sound cities is showing renewed activity, and residence construction is keeping pace with levels heretofore announced, in Seattle especially. Big construction is getting well under way with the erection of several school buildings, a number of apartment houses, moving-picture theatres, hospitals and six business structures, including a two-million-dollar building for the Pacific Telephone Company. However, the full benefit of this construction will not be felt by electrical jobbers and contractors until midsummer and early fall. Additional contracts have been awarded Seattle steel shipyards for tankers, and it is reported that the Portland yards have closed further contracts. Lack of steel is all that is withholding reopening of nearly every yard in this section. The freight embargo has seriously affected business. All promises for shipments are off for the present. Business continues about the same as last week, if anything a little better. Collections are still somewhat slow, but it is felt that this is only temporary and largely due to income and local taxes. The shortage of motors, both new and second-hand, is becoming acute.

Farm-Lighting Plants.—One Seattle firm doing a large business in lighting plants states that for the first time in the history of the industry in the Northwest there is plenty of stock on hand to handle the demand which is very good. A majority of the sales are being made to farmers in western Washington and Oregon, although demand from Puget Sound points is showing increases. Prices are showing a steady trend.

Motors.—Demand for larger sizes is light, although inquiries from lumbering and logging interests contemplating electrification of their industries continue coming in. Demand for fractional sizes far exceeds available stocks; in fact, stocks are next to impossible to obtain, especially in single-phase.

Lamp Cord.—Stocks are low in Seattle and other Puget Sound cities and demand increasingly heavy, deliveries being obtained in from two to four months. Prices recently advanced approximately 10 per cent.

Porcelain Fittings.—Available supply is not sufficient to meet increasing demands. Deliveries are exceedingly hard to obtain. Tubes are particularly scarce. Prices are trending upward. Weatherproof wire shipments average from two to six months in face of brisk demand. Stocks of smaller sizes are especially low, prices fluctuating with the upward trend.

SAN FRANCISCO

Although business is still at high tide, there is a growing feeling that provision should be made for future requirements in a conservative manner. The electrical industry is in general so closely allied to the building trades that the necessary activity in them will stimulate it for months to come, but in other retail lines there are unmistakable signs of retrenchment.

Washers.—There is a lull in the call, caused in part by the usual shortage of one or another make, but principally by the passing of the washers market from a sellers' to a buyers' market. Prices are still averaging $140 cash for a swinging wringer machine, family size.

High-Tension Insulators.—Deliveries are poor, due to manufacturing difficulties. Factories are behind their schedules, and in certain types no deliveries can be made for a year. Demands are normal for this time of the year.

Line Tools.—Business is active in construction tools and stocks are fairly good, with the exception of a general shortage of the smaller tools, such as pliers, "come-along" grips and cable splicers. The small tool situation, however, is improving, and normal stocks are expected within a few months.

Appliances.—Demand remains active, but stocks are low in the heating-device line. Factories are fairly behind, although a noticeable advance in production is being made. Normal stocks cannot be expected until along in the spring of 1921.

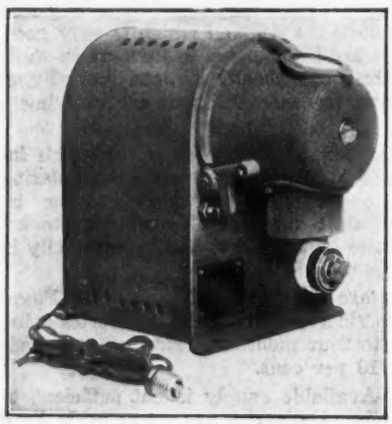
Schedule Material.—Large orders are being placed and deliveries are still fairly good in some lines, but in general factories are from three to four months behind production and no improvement for coast cities is looked for until next year.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Insulated Wire Stripper

The France Manufacturing Company, Cleveland, Ohio, has developed a machine for stripping insulation from stranded wire, single-conductor wire, enamel-insulated wire and duplex cord. Motor-driven knives rotate continuously



ROTATING KNIVES STRIP WIRE

and are adjustable to any size of wire, says the manufacturer. All moving parts are completely inclosed. The stripper is equipped with either a single phase, 110-volt, 60-cycle motor or a 110-volt direct-current motor. It is said to be especially useful in all stripping work where the volume is large.

Shade Holder for Plug Clusters

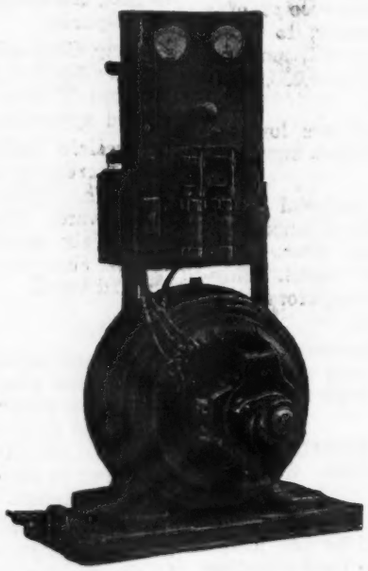
A shade holder for use with its No. 92 two-way plug clusters has been put on the market by the Benjamin Electric Manufacturing Company, Chicago.

Low Reader Ammeter and Voltmeter

The Rawson Electrical Instrument Company, Cambridge, Mass., has just placed on the market an instrument which it has named the "Multimeter." The possible uses to which this can be put, says the manufacturer, cover a wide range of measurements. There are five ranges in micro amperes and milliamperes, four ranges in millivolts and four ranges in volts, covering readings from 1 microampere to 1 amp., 50 microvolts to 100 millivolts and 0.01 volt to 600 volts. With the use of external shunts the current range can be extended to any desired value. All ranges are plainly engraved on the face of the polished condensite panel.

Farm Light and Power Generator and Panel

The Westinghouse Electric & Manufacturing Company has placed on the market a line of electric generators and control panels for use with internal-combustion engines for farm light and power service. These electric generating units are made in standard capacities from ½ kw. to 2 kw. and are adapted for operation with 32-volt battery equipment. The generators are built to be directly connected or belt driven. The belt-driven generators are equipped with sliding bases with adjustment to keep the belt at the proper tension. They are shunt-wound for normal operation, but have an additional



NON-AUTOMATIC ELECTRIC GENERATING UNIT FOR FARM-LIGHTING OUTFIT

series winding which allows the generator to be operated as a compound motor.

The control panel is made of sheet steel and is mounted directly on the generator. On the panel are a voltmeter, an ammeter, a rheostat, a line switch, line fuses, a series field (starting) switch, an ignition (stopping) switch and a reverse-current relay.

An automatic stop is supplied with these panels when desired. The stop consists of a clock, mounted on top of the panel, which can be adjusted to cut the engine ignition circuit when the battery has been fully charged. This panel is therefore semi-automatic, since it is only necessary to start the unit manually—the clock mechanism automatically stopping the unit.

Water Heater

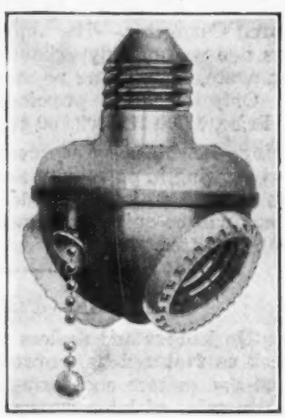
The Electric Heating & Manufacturing Company, Seattle, Wash., has just placed on the market its "Coppersert" electric water heater. It is said to be an improved type of Apfel's "Electric Insert" water heater, possessing the following characteristics: Heating element does not come into contact with either air or water and is therefore not subject to corrosion; it is always surrounded by the body of water being heated; element is inclosed in seamless copper tubing to eliminate corrosion, which, the manufacturer says, affords 50 per cent quicker heat transmission; no changing of pipes is necessary to install; no siphoning of tank is possible, reducing liability of turn-outs; it does not interfere with other methods of heating the water. The heater is made in 600, 1000, 1500 and 2000-watt sizes for alternating or direct current.

Alloy for Bonding Aluminum to Brass and Copper

The Mirete Company of Massachusetts, Inc., Springfield, Mass., has developed a new alloy for bonding aluminum to brass, copper or other metals. The manufacturers say it has a conductivity that approaches 90 per cent that of pure aluminum and that the bond is absolutely permanent. The alloy is called "Mirete" metal and can be used with an ordinary gasoline torch. Its tensile strength as given is as great as that of aluminum itself, with a higher elastic limit. Exhaustive tests show for it oxidation not so great as aluminum or copper and little evidence of electrolysis. It is claimed that with the use of this alloy the resistance loss at points of connection can be overcome either on aluminum or copper wire.

Two-Way Plug with Pull Chain

The Benjamin Electric Manufacturing Company, Chicago, has developed the Benjamin pull plug, the pull-chain



CHAIN CONTROLS ONE OUTLET

mechanism of which controls one of the outlets, which permits the lamp to be turned on and off without interfering with the use of an appliance on the other outlet.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE PERFECTION STORAGE BATTERY COMPANY, Fortieth St. and Rhodes Ave., Chicago, announces the appointment of territorial distributers for its Perfection and Jupiter light and power plants and Perfection storage batteries as follows: State of New Jersey, Edward C. Daniels, Rutherford, N. J.; Maryland and Delaware, Perfection Battery Service Station, Inc., 1,417 Maryland Ave., Baltimore; Virginia, North and South Carolina, Farmers' Delight Company, 413 Lyric Building, Richmond, Va.; Tennessee, Georgia and Florida, Southern Machinery Company, 9294 South Forsythe St., Atlanta; Alabama, Dixie Electric Company, Montgomery; Kansas, Nebraska and southern half of Illinois, Perfection Farm Light Company, Kansas City and St. Louis, Mo.; North and South Dakota, Minnesota, Nebraska and Iowa, McMains Sales Company, Des Moines, Iowa, and Omaha, Neb.; New England States, W. T. Richardson & Company, Tremont Building, Boston; New Zealand, Electrical Equipment Company, 122 Customs St. East, Auckland, N. Z.; Commonwealth of Australia, Ramsey, Sharp & Company, Sydney, New South Wales; India, Eastern Electric & Trading Company, Bombay and Karachi; Cuba, Fierros & Rodriguez, Havana; Porto Rico, R. M. Delgado, Ponce.

THE MONROE LAMP COMPANY, 310 West Fourteenth St., New York, N. Y., has increased its capital stock from $100,000 to $250,000.

THE CROUSE-HINDS COMPANY, Syracuse, N. Y., manufacturer of condulets, is planning to build an addition, 70 ft. x 260 ft., to its foundry.

THE MORSE CHAIN COMPANY, Ithaca, N. Y., announces the removal of its offices from Greensboro, N. C., to 404 Commercial Bank Building, Charlotte, N. C. George W. Pritchett the Southeastern manager, has found this change advisable owing to the great increase in the use of Morse silent chains throughout the textile industry, which has had such a phenomenal growth, necessitating the building of new mills and increasing the capacity of all mills in the South.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, announces the removal of its Cleveland office from the Williamson Building to the Vickers Building, Sixty-fifth St. and Euclid Ave. J. E. Wood, district manager, will continue in charge of this office.

THE ILLINOIS TESTING LABORATORIES, Inc., electrical engineers, have moved into new and larger quarters at 430 South Green St., Chicago. This change was made necessary on account of increasing business. It is proposed to increase the scope of the work, particularly along the lines of developing new apparatus and doing an increased amount of testing and engineering work.

W. E. THAU, general engineer for the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been appointed engineer in charge of the marine section of the engineering department. Mr. Thau was graduated from the University of Cincinnati in 1911 and entered the apprenticeship course of the Westinghouse company. Later he become engaged in the steel mill and marine work. He has been in marine engineering work since the company became actively associated with the development of electrical equipment for this type of service.

THE WAYNE OIL TANK & PUMP COMPANY, Fort Wayne, Ind., is bringing out some new oil filters for turbines and engines and a complete oil-burning equipment for use under boilers.

L. H. KLEIN has been appointed general sales manager of the R. D. Nuttall Company, and W. H. Phillips has been appointed manager of equipment.

THE UNIVERSAL ENGINEERING & ELECTRIC COMPANY, 508 McKinley Avenue, N. W., Canton, Ohio, has been organized recently to do an engineering and construction business in northern Ohio.

LANDERS, FRARY & CLARK, New Britain, Conn., at its annual meeting elected the following officers for the coming year: Charles F. Smith, chairman of board of directors; Arthur G. Kimball, president; Frederick A. Searle, Joseph F. Lamb, Frank J. Wachter and Herbert A. Johnson, vice-presidents, the last named in charge of production; Pardon C. Rickey, treasurer; Edward F. Hall, secretary; John W. Abell and D. Niles Sheppard, purchasing agents.

THE BRYAN MARSH DIVISION, National Lamp Works of the General Electric Company, Chicago, announces that it will occupy its new offices at 623-33 South Wabash Avenue, Chicago, after May 1.

JOSEPH G. BROBECK has opened an office at 120 West Thirty-second Street, New York City, for the sale of the Simplex Wire & Cable Company's products. Mr. Brobeck has been connected with the Simplex company in a sales capacity for twenty

JOSEPH G. BROBECK

years, ten of which were spent in Chicago and ten in Boston. His territory comprises New York State, Connecticut and the counties of New Jersey, adjoining New York City.

THE NATIONAL CONDUIT & CABLE COMPANY, INC., Hastings-on-Hudson, N. Y., has during the past year made extensive improvements to its mills, having entirely remodeled and enlarged its cable mill. New equipment has been installed throughout, with a greatly enlarged capacity, to meet the ever-increasing demands for cable, etc.

THE ELECTRIC FURNACE CONSTRUCTION COMPANY, Philadelphia, Pa., announces the appointment of agents for "Greaves-Etchells" electric steel furnaces as follows: H. M. Smith, 309 Schofield Building, Cleveland, Ohio; A. S. Lindstrom, 519 California Street, San Francisco, Cal.; McCrum & Gillem, 1011 Empire Building, Birmingham, Ala.; D. P. Morisseau, General Welding & Supply Company, Wainwright Building, St. Louis, Mo.

THE PEERLESS ELECTRIC COMPANY, Warren, Ohio, has placed contracts for additional factory buildings which will increase its floor space by approximately 15,000 sq.ft.

L. B. STILLWELL & H. S. PUTNAM, consulting engineers, and the L. B. Stillwell Engineering Corporation, constructing engineers, now at 100 Broadway, New York, announce the removal of their offices on May 1 to 143 Liberty Street.

THE ARTHUR JONES ELECTRICAL COMPANY, 2837 South State Street, Chicago, Ill., contemplates erecting a new plant at Calumet Avenue and Twenty-ninth Place to cost about $60,000.

THE DOVER MANUFACTURING COMPANY, Dover, Ohio, manufacturer of electric irons, is planning to erect a three-story addition, 80 ft. by 200 ft.

THE McGILL MANUFACTURING COMPANY, Valparaiso, Ind., manufacturer of lamp guards, pull-chain sockets, etc., has awarded contract for the erection of two buildings on Campbell Street, 104 ft. by 206 ft. and 52 ft. by 78 ft.

THE FAHNESTOCK ELECTRIC COMPANY, Meadow Street, Long Island City, N. Y., has awarded contract for the erection of a two-story reinforced-concrete plant, 50 ft. by 100 ft., at East Avenue and Eighth Street, to cost about $50,000.

THE CLEVELAND ELECTRIC MONORAIL COMPANY, Cleveland, Ohio, is planning to build a plant at Wickliffe, Ohio, for the manufacture of overhead carrying systems.

J. LIVINGSTON & COMPANY, 70 East Forty-fifth Street, New York, N. Y., has filed notice of an increase in capital stock from $450,000 to $600,000.

THE AMERICAN STORAGE BATTERY COMPANY, Cambridge, Mass., is erecting a plant at Fernwood, Pa., where it will manufacture its complete products.

MATHEW H. DEVEY, Trenton, N. J., is organizing a company, to be known as the Devey Manufacturing Company, to establish a plant to manufacture electrical products, including conduits and other specialties.

THE CARTER HAGER ELECTRIC CORPORATION, Buffalo, N. Y., manufacturer of electric specialties, has filed notice of change in name to the Hertel Electric Corporation.

THE AMERICAN LIGHTING COMPANY, 800 Sibley Street, Chicago, manufacturer of Davis flood lamps and allied specialties, has leased a three-story building containing 36,000 sq.ft., at the corner of Polk and Sibley Streets.

THE EDWARD N. RIDDLE COMPANY, Toledo, Ohio, manufacturer of electric lighting fixtures, has acquired a building which will be remodeled for manufacturing purposes.

THE COOPER STORAGE BATTERY COMPANY, Madisonville, Ohio, has awarded a contract for the construction of a two-story addition to its plant, 80 ft. by 100 ft. Plans are also under way for another addition of the same dimensions, on which work will not be started until the one under contract is completed.

THE NATIONAL RADIO COMPANY, San Francisco, Cal., is planning to erect a two-story plant, 95 ft. by 245 ft., on Twentieth Street, near Folsom, for the manufacture of wireless and radio equipment. It will cost about $65,000.

THE STANDARD ELECTRIC WELDING COMPANY, Philadelphia, Pa., has removed its plant from Emerald and Firth Streets to 1939-41 East Sergeant Street.

THE DUPLEX STORAGE BATTERY COMPANY, 637 Edison Avenue, Milwaukee, Wis., is planning to erect a plant in West Allis, to cost with equipment about $50,000.

THE COOK ELECTRIC COMPANY, Jelliff Avenue and Runyon Street, Newark, N. J., is having plans prepared for a one-story plant, 22 ft. by 95 ft.

GRAY & DAVIS, INC., Cambridge, Mass., has received an order from its French representative amounting to more than $700,000. To meet the increasing demand for its systems the company has found it necessary to increase its output to 800 systems per day.

HARVEY HUBBELL, INC., Bridgeport, Conn., contemplates the construction of a building on State Street, near its present works, in addition to the manufacturing building, 90 ft. by 100 ft., for which contract has been awarded.

THE OSGOOD-BRADLEY CAR COMPANY, West Boylston Street, Worcester, Mass., manufacturer of electric cars, etc., is planning to build a three-story addition to its plant, to cost with equipment about $300,000.

WILLIAM A. BERTSCH has been appointed receiver of the South Bend Current Control Company, South Bend, Ind. The company manufactures electric time switches.

THE DUPLEX STORAGE BATTERY COMPANY, now occupying leased quarters at 637 Edison Avenue, Milwaukee, Wis., contemplates erecting a plant of its own in West Allis, to cost with equipment about $50,000.

THE GENERAL ELECTRIC COMPANY has acquired a large block of common shares of stock of the Hurley Machine Company, Chicago.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is arranging to increase its capital from $5,000,000 to $7,500,000.

THE OTIS ELEVATOR COMPANY, New York City at its annual stockholders' meeting voted favorably on the proposition to increase the authorized common stock from $10,000,000 to $15,000,000.

THE GENERAL ELECTRIC COMPANY has acquired the Feuchtwanger chemical plant at Little Ferry, N. J., for use of the Edison Lamp Works. The buildings have a total area of 35,000 sq.ft. and will be used for chemical work in connection with the manufacture of lamps.

AMERICAN DIELECTRICS, LTD., is the name of the new company recently organized by John H. Barker, 95 Liberty Street, New York City, and his brother, Charles A. Barker, formerly chief engineer of the John C. Dolph Company. D. J. Manson will be chief chemist, A. E. Horn associate chemist, and W. F. Eagan, formerly of the research department of the Westinghouse Electric & Manufacturing Company, electrical engineer. Charles A. Barker is chief engineer and John H. Barker is sales manager. American Dielectrics, Ltd., has arranged with the Horn-Holland Company, Long Island City, N. Y., to produce insulating varnishes and compounds under its direction. The latter company has abundant manufacturing and financial capacity, according to J. H. Barker.

THE LINCOLN ELECTRIC COMPANY, Cleveland, Ohio, is building an addition to its factory which will increase its manufacturing floor space by about 70 per cent. The new building will be used to increase the production of alternating-current motors and arc welders.

Supply Jobbers' Notes

THE ROBERTSON-CATARACT ELECTRIC COMPANY, Buffalo, N. Y. has purchased two three-story brick buildings adjoining its store at Huron and Niagara Streets, which it plans to occupy in the near future.

THE WESTERN ELECTRIC COMPANY, INC., has established an office at 233 Harris Avenue, Providence, R. I., in charge of N. I. Allen. The Rhode Island trade will be given special attention from this headquarters.

THE MATTHEWS ELECTRIC SUPPLY COMPANY, Birmingham, Ala., announces that it will establish a branch at 59 Water St., Mobile, Ala., which it expects to have in operation by May 15. The company intends to handle its business in southwest Georgia, Florida, south Alabama, south Mississippi and south Louisiana through the Mobile branch. John W. Black will be in charge of this office.

THE MOHAWK ELECTRICAL SUPPLY COMPANY of Syracuse, N. Y., has added to its sales organization C. S. Buller of the commercial department of the Public Service Company, Newark, N. J. Mr. Buller will confine his efforts to exploiting and selling throughout New York State Edison "Mazda" lamps, "Ivanhoe" reflectors and "Duplexalite" fixtures. As a graduate electrical engineer and with many years of experience in the commercial lighting work Mr. Buller will be in position to co-operate with the general salesmen in the above company and with electrical dealers to recommend and lay out up-to-date lighting installations.

Foreign Trade Notes

THE CANADIAN GENERAL ELECTRIC COMPANY, Ltd., in its annual report for the year ended Dec. 31, 1919, states that the manufacturing situation at the end of the war was far more discouraging than at the commencement of the war, but has since improved to a remarkable extent. For the first six months of the year, owing to the hesitancy of the public in placing orders, conditions were far from encouraging, but as the year progressed new business was offered in an ever-increasing volume. For the second half of the year sales exceeded those of the first half by 115 per cent. During the later months sales exceeded those of any previous period in the history of the company, and for the last three months they have reached an average of over $2,000,000 per month. In the judgment of the directors the demands for the products of the company will continue to increase at least for some years to come, for the reason that the electrical industry has a certain assurance for the future which begets a feeling of confidence and warrants constructive effort. The manufacturing and distributing facilities of the company being overtaxed, new extensions and additions have been authorized and are being carried out, as the future of the company's activities is more assured and promising than at any previous period. A new factory for the manufacture of interior conduit has been completed and is about to start operations. A new factory for electrical fittings and supplies will, when completed, contain about 170,000 sq.ft. of manufacturing floor space.

THE WONHAM, BATES & GOODE TRADING CORPORATION, 17 Battery Place, New York, announces that it has been established jointly by Wonham, Bates & Goode, Inc. of New York, E. Naumburg & Company of New York and M. Samuel & Company, Ltd., of London, for the purpose of enlarging and expanding foreign business, both export and import, carried on for many years by Wonham, Bates & Goode, Inc., at 17 Battery Place, New York. The active management of the company will remain in the hands of the present officers. The new company, through its affiliations, has immediate benefit of many foreign connections and branches in addition to those inherited from the old firm. It will be identified commercially with M. Samuel & Company, Ltd.'s branch houses established for many years in Japan, China, the East Indies, etc. The new corporation will specialize in transmission line equipment.

D. U. E. G. IN SPANISH HANDS?—Reports from Germany are to the effect that control of the Overseas Electric Company, commonly known in the United States as the D. U. E. G., has passed into the hands of a syndicate floated in Spain. It is not known whether the old interests, which were closely allied to the A. E. G. (Allgemeine Electricitäts-Gesellschaft) have sold their holdings to Spanish interests or whether perhaps advantage was taken of the opportunity to finance in money other than marks. The company, which was a powerful factor before the war in German trade in South America, controls electric light plants and street-railway systems in Argentina and Chile. Doubt has been expressed in the United States whether the Allies will permit such a powerful concern to escape from German control while the matter of reparations is still to be settled.

THE TOYO ALUMINUM COMPANY, which had been promoted by combined interests of Japan and America, was established on Dec. 8, 1919, with a capital stock of $5,000,000 for the purpose of manufacturing aluminum by electric process. Water-power rights sufficient to develop 18,000 kw. have been secured, and steps are being taken to obtain further water rights to develop 100,000 kw. The company is said to be the first to attempt the manufacture of aluminum in Japan. Dr. Jokishi Takamine, 120 Broadway, New York, N. Y., is one of the promoters.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An electrical dealer in Spain (No. 32,532) desires to purchase 100 telephones, magnetic, with generators of three and five magnets, with combined hand transmitter and receiver (European style), and also bells for telephones.

A merchant in Spain (No. 32,540) wishes to secure an agency for the sale in that country and Portugal of electric wiring and lighting equipment, motors and generators.

A firm of ironmongers in Scotland (No. 32,545) desires to secure the sole agency for the sale of electrical goods, vacuum cleaners, etc.

Trade Publications

PUMPS.—Centrifugal pumps of the single-stage and multi-stage types for various services are described in a well-illustrated catalog just issued by the De Laval Steam Turbine Company, Trenton, N. J.

FUSES—The Star Fuse Company, 290 Church St., New York, N. Y., has issued a folder listing and illustrating its fuses under its most recent prices.

CONDENSITE.—The Condensite Company of America, Bloomfield, N. J., is circulating a booklet entitled "Condensite" for engineers, designers and purchasers, in which it describes the properties of condensite, shows how it is molded, how to design it and how to specify it.

ELECTRIC GENERATING SETS.—"Ker-O-El" is the title of a booklet published by the Matthews Company, Port Clinton, Ohio, in which it describes and illustrates its new "Ker-o-el" kerosene or gasoline electric generating sets for farm power and lighting systems.

ILLUMINATION.—The Cooper Hewitt Electric Company, 95 River St., Hoboken, N. J., has issued a "Portfolio of Industrial Illumination" containing photographs showing illuminating effects in large industrial plants.

New Incorporations

THE UNITED STATES BATTERY COMPANY of Passaic, N. J., has been incorporated by Joseph J. Flood, Aaron L. Simon and Mortimer R. Simon. The company is capitalized at $200,000 and proposes to manufacture electric batteries.

THE BLAU SERVICE, INC., has been incorporated with a capital stock of $125,000 to manufacture electrical appliances. The incorporators are: Edward Blau and Ellis J. Cook.

THE NEW JERSEY LAMPS WORKS of Newark, N. J. has been incorporated with a capital stock of $125,000 by Ascher Herman and Maurice S. Maurer to manufacture electric lamps.

THE YORK (ALA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $10,000 by J. B. Ross and others.

THE LITTLE RIVER LIGHT & POWER COMPANY of Mount Carmel, S. C., has been organized with a capital stock of $20,000 to construct an electric light plant. L. L. Hester is president.

THE ALLIED STORAGE BATTERY COMPANY of Montclair, N. J., has been incorporated by F. S. and Beverly Weilbacher and William Von Hollen. The company is capitalized at $50,000 and proposes to manufacture electric storage batteries.

THE CARMICHAEL 8-IN-1 PLUG CORPORATION of New York, N. Y., has been incorporated with a capital stock of $100,000 to manufacture fuse plugs and other electrical specialties. The incorporators are H. and E. Carmichael and S. E. Haupt, 201 East 115th Street, New York City.

THE GREER ELECTRIC CONSTRUCTION COMPANY of New York, N. Y., has been chartered by J. Greer, C. F. Zweifel and P. R. Kuhn, 1343 Lexington Avenue, New York City. The company is capitalized at $50,000 and proposes to manufacture electrical equipment and supplies.

THE MOMAC COMPANY, INC., of Trenton, N. J., has been incorporated with a capital stock of $100,000 to manufacture lighting equipment. The incorporators are Charles E. McCullough, Maurice A. Mackey and Stewart H. O'Donnell.

THE IDEAL ELECTRIC HEATER COMPANY of Pittsburgh, Pa., has been incorporated by W. I. N. Lofland, Mark W. Cole of Dover, Del., and Wilber A. McCoy of Pittsburgh, Pa. The company is capitalized at $100,000 and proposes to manufacture electric heating appliances, etc.

THE CANADIAN LINE MATERIALS, Ltd., of Hamilton, Ont., has been incorporated by Thomas H. Barnard, John L. Counsell, Ralph R. Bruce and others. The company is capitalized at $200,000 and proposes to manufacture electric transmission and electric railroad line materials, etc.

New England States

AUBURN, ME.—The Androscoggin Electric Company of Lewiston is contemplating the erection of a substation on Turner Street in the near future.

SKOWHEGAN, Me.—The Central Maine Power Company has appointed John Calvin Stevens of Portland as consulting architect to design its new power house in Skowhegan.

FARMINGTON, N. H.—The plant of the Cloutman Gas & Electric Company has been taken over by the Twin State Gas & Electric Company. Electricity for operating the local system will be transmitted from the Dover plant of the latter company.

GLOUCESTER, MASS. — Improvements to the street-lighting system are under consideration by the Council.

HOLYOKE, MASS.—The Mayor and Board of Aldermen have approved the bill to be introduced in the State Legislature permitting the city of Holyoke to incur indebtedness in excess of its borrowing limit to an amount not exceeding $2,000,000. This additional amount is asked for extensions to the municipal electric light plant and also for the proposed new plant, recommended by John J. Kirkpatrick, manager, on the old sawmill site, above the Holyoke dam and adjacent to the Boston & Maine Railroad.

WESTFIELD, MASS.—The special committee appointed to investigate the Municipal Electric Light Department has recommended the sale of the municipal plant. The value of the plant is placed at $600,000.

BRIDGEPORT, CONN.—Work has been started on the foundations of the proposed new power station of the United Illuminating Company on East Main Street near Water Street. The plant will be completed by 1921 and will cost about $3,000,000. The plans provide for an ultimate capacity of 100,000 kw., with an initial installation of 30,000 kw., consisting of three 10,000-kw. turbo-generators and six 750-hp. Babcock & Wilcox boilers. Westcott & Mapes of New Haven are engineers.

SOUTH NORWALK, CONN.—Commissioners of the South Norwalk Electric Works is reported to be considering the question of obtaining energy from the Connecticut Light & Power Company with the view of extending the service.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received at the office of Edward S. Walsh, Superintendent of Public Works, Albany, until May 18, for electrical and mason work at the Barge Canal terminal at Greenpoint, Brooklyn, (terminal contract No. 104). Copies of detailed plans or drawings may be obtained at the office of the State Engineer and Surveyor at Albany, N. Y.

ALBION, N. Y.—The Western New York Utilities Company has applied to the Public Service Commission for permission to construct an electric light plant in Barre and also to exercise a franchise in the towns of Barre and Kendall. Surveys for the proposed transmission lines have been made.

BLACK RIVER, N. Y.—The St. Regis Paper Company contemplates the erection of a power house on the Black River, to generate 7,500 hp. The cost is estimated at about $500,000.

BROOKLYN, N. Y.—The New York Telephone Company has awarded contract to the Gillies-Campbell Company, 110 Park Avenue, New York, N. Y., for the construction of a four-story telephone exchange, at Liberty Avenue and Milford Place, to cost $200,000.

NEW YORK, N. Y.—Plans are being prepared by the Board of Trustees of Columbia University for the erection of a new power plant at the Teachers' College, 120th Street near Broadway, to cost $100,000, including equipment.

NEW YORK, N. Y.—Plans have been completed by the New York Edison Company for the erection of a two-story substation on Inwood Avenue, near 170th Street. The cost, including equipment, is estimated at $250,000.

NEW YORK, N. Y.—Contract has been awarded to the Northeastern Construction Company, 101 Park Avenue, for the erection of a transformer station on Irving Place and Fifteenth Street, to cost about $100,000, by the New York Edison Company.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

ROCHESTER, N. Y.—The Fred T. Ley Company, Springfield, Mass., has been awarded contract by the Eastman Kodak Company for the construction of a new power plant, to cost, including equipment, $200,000.

ROME, N. Y.—Plans are being prepared by the board of managers, State School for Mental Defectives, for the erection of a central light and power plant, to cost about $120,000.

WATERTOWN, N. Y.—The Beebe Island Utilities Company has awarded contract to J. G. White Engineering Company, 43 Exchange Place, New York, N. Y., for the erection of a hydro-electric plant on Beebe Island, to cost about $1,000,000.

CAMDEN, N. J.—Eavenson & Levering, 217 Atlantic Avenue, have awarded contract to George Kessler, Drexel Building, Philadelphia, Pa., for the erection of its proposed plant, including machine shop, power house, scouring mill, etc., to cost between $500,000 and $600,000.

SOUTH RIVER, N. J.—Bids will be received by the Board of Public Works and the Borough Council until May 10 for design, construction, furnishing and installing machinery and equipment for an addition to the municipal electric generating plant as follows: (1) Construction of building and foundations; (2) furnishing and erection of two 300-hp. boilers; (3) two 500-kw. turbo-generator units; (4) two 500-kw. surface condensers, two air pumps and two circulating pumps; steam piping for two boiler-feed pumps and one water heater; (6) construction of coal trestle and guyed steel or radial brick chimney. Copies of specifications may be obtained at the office of Goss, Bryce & Johnson, engineers, 55 Liberty Street, New York, upon payment of $5. E. B. Hedden is superintendent of public works.

PHILADELPHIA, PA.—Permit has been taken out by the Philadelphia Electric Company for the erection of an addition to its transformer station at Marshall and Noble Streets, to cost about $75,000.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company, is planning to build a generator house at Race and Leadenhall Streets, to cost about $20,000.

HAGERSTOWN, MD.—A committee appointed by the Hagerstown Chamber of Commerce is planning extensions to the street-lighting system. A. K. Coffman is chairman.

CECIL, W. VA.—The Sterling Coal Company plans to rebuild its tipple and power plant, recently destroyed by fire. The loss is estimated at $50,000.

LOGAN, W. VA.—The Guyan Machine Shops are in the market for two 400-kva., 2,200-volt, three-phase, 60-cycle turbo-generators, complete, with water tube boilers, condensers, cooling tower, switchboard, pumps, etc. B. Shell is manager.

WHEELING, W. VA.—Plans have been completed by the city engineer for the installation of an ornamental street-lighting system, for which estimates have been asked.

WHEELING, W. VA.—Extensions and improvements contemplated or under way by the Whitaker-Glessner Company of Wheeling, to be completed in 1920, include the following: At Wheeling mill, new boiler and power house; at Portsmouth (Ohio) works, eighteen-continuous-sheet bar, billet and blast mill, power-house addition, equipment for handling river coal; new warehouse and factory building at Kansas City, Mo., etc. The cost of the entire works is estimated at $1,052,140. Andrew Glass is president.

WASHINGTON, D. C.—Bids will be received at the Machinery and Engineering Materials Branch, Treasury Department, Washington, D. C., until May 11, for telephone and telegraph material under circular M. E. 199.

North Central States

DETROIT, MICH. — The Wisconsin Bridge & Iron Company, 1362 Penobscot Building, has been awarded contract by the Clayton-Lambert Company, 1380 Beaubien Street, for the construction of a factory, 210 x 300 ft. and a power house, 42 x 42 ft. Equipment for power plant, it is understood, has not yet been purchased. F. F. Van Tuyl, Union Trust Building, is engineer.

GRAND RAPIDS, MICH.—Plans are being prepared for the construction of a tire plant at Fuller Avenue and Grand Trunk Railway, to cost $400,000, by the Grand Rapids Tire & Rubber Company, 315 Kelsey Building. The plant will be equipped for electrical operation. H. H. Swan is factory manager.

HILLSDALE, MICH.—Bids will be received by the Board of Public Works, City Hall, Hillsdale, until May 21, for furnishing the following equipment: One 1,000-kw. steam turbo-generator with condenser; one 400-hp. water tube boiler with stokers; one 1,500-gal. per minute motor-driven centrifugal pumping unit. Specifications may be obtained upon application to the Board of Public Works.

MENOMINEE, MICH.—The Hoskins-Morainville Paper Company has awarded general contract for a paper mill, consisting of main building, boiler house, power plant and 200-ft. concrete stack, to H. J. Selmer of Green Bay, Wis. The cost of proposed plant with equipment is estimated at $875,000.

PONTIAC, MICH.—Bids will be received by the city of Pontiac until May 17 for the construction of a filtration plant, to cost about $500,000. The plans provide for electrically driven pumps. C. W. Hubbell, 2348 Penobscot Building, Detroit, Mich., is engineer.

CLEVELAND, OHIO.—Contract has been awarded by the Jordan Motor Company, 1070 East 152d Street, for the erection of a factory and power house to be erected on East 152d Street, near St. Clair Avenue, to cost about $300,000. New equipment, including two 250-hp. boilers, with coal-handling apparatus, stokers, bunkers, etc., it is understood, is to be purchased. Paul Jones is secretary and treasurer.

DAYTON, OHIO.—Extensions are contemplated by the Dayton Power & Light Company, involving an expenditure of $1,500,000. The work will include doubling the capacity of the Miller's Ford station and extending the service in several new sections of the city.

LISBON, OHIO.—Plans are being made by the Ohio Gas & Electric Company to extend its transmission lines on Canton road and also to Willow Grove Park. A line to Elkton and other adjoining districts is also under consideration.

WARREN, OHIO—The General Fire Extinguisher Company will erect a foundry, to cost about $350,000, to be equipped with electrically driven machinery. The H. M. Lane Company, 701 Owen Building, Detroit, Mich., is engineer.

WORTHINGTON, OHIO.—The installation of an electric street-lighting system is under consideration.

ASHLAND, KY.—The capital stock of the Boyd County Electric Company has been increased to $220,000.

PRAISE, KY.—Plans are under consideration by the Kanawha-Elkhorn Collieries Company of Praise for the installation of electrical equipment at its local plant, including generators, etc. R. C. Simpson is general manager. The main offices of the company are at 217 Ellicott Square, Buffalo, N. Y.

ANDERSON, IND.—Extensions and improvements to the municipal electric light plant, to cost about $316,000, are under consideration.

BARGERSVILLE, IND.—Contract has been awarded to N. E. White of Moran for the installation of an electric light plant in Bargersville.

COLUMBIA CITY, IND.—Plans are being considered for extension of the municipal electric lighting service to the town of Larwell, a distance of 8 miles.

HOBART, IND.—The State Board of Tax Commissioners has authorized the issue of $50,000 in bonds for improvements to the municipal electric light and power plant.

MOUNT VERNON, IND.—The city of Mount Vernon has applied to the Indiana Public Service Commission for permission to purchase the Mount Vernon Light & Power Company.

MUNCIE, IND.—Extensions and improvements to the municipal electric plant, to cost about $200,000, are under consideration by the City Council.

RICHMOND, IND. — The City Council contemplates extensions and improvements to the municipal electric power plant, to cost about $200,000.

LINCOLN, ILL.—The Lincoln Water & Light Company contemplates the installation of a new turbo-generator to cost about $6,000.

BUTTERNUT, WIS.—W. J. Schultz, owner of the local electric light plant, contemplates reconstruction of the plant, including installation of machinery to increase the output by 150 hp.

GALESVILLE, WIS.—Preparations are being made by the Davis Mill & Electric Company for changing its system from direct to alternating current. Contracts, it is understood, are now being placed for equipment and machinery. The company supplies electricity to the municipality and local industries.

MILWAUKEE, WIS.—Contract has been awarded by the Department of Public Works, to W. F. Cummings Company, 330 South Paulina Street, Chicago, Ill., for the installation of a street-lighting system, to cost about $320,000.

MILWAUKEE, WIS.—The park board has accepted the plan of the Municipal Bureau of Illumination for lighting Washington Park with electricity, replacing naphtha lamps now in use. The plans provide for 160 lamps.

ORFORDVILLE, WIS.—The Southern Wisconsin Power Company of Madison, it is reported, will erect a high-tension transmission line from Jonesville to Orfordville.

RICE LAKE, WIS.—At an election held recently the proposal to take over the local electric lighting system of the Wisconsin-Minnesota Light & Power Company at the expiration of the present contract was carried.

ST. PAUL, MINN.—Montgomery, Ward & Company of Chicago, Ill., it is reported, will soon award contracts for the construction of a merchandise building, ten stories, 340 ft. x 220 ft., and an administration building, three stories, 85 ft. x 80 ft., at St. Paul. Separate contract will be awarded later for construction of a 12,000-kw. power plant. The total cost of the project is estimated at about $4,000,000.

VIRGINIA, MINN.—Contract has been awarded by the Water and Light Commission for the installation of two 775-hp. boilers and stoker in the municipal light plant.

BURLINGTON, IOWA.—Contract for electric wiring of the Showers' Brothers furniture store, now under construction, has been awarded to the Home Electric Company of this city. Contract for the electric power system has not yet been awarded.

KANSAS CITY, MO.—Plans have been completed and an ordinance has been sent to the City Council for a new street-lighting system in Fiftieth Street, from Brooklyn to Prospect Avenue. Single 400-cp. tungsten lamps will be used.

KANSAS CITY, MO.—Negotiations are under way by the Kansas City Power & Light Company for the purchase of the distributing system of the North Kansas City Light, Heat & Power Company, which is valued at about $150,000. The latter company buys its energy from the Kansas City company.

GRAFTON, NEB. — The installation of two 25-hp. oil engines, directly connected to 15-kw., 125-volt direct-current generators, and one 2,000 gal. tank and pumping equipment in the municipal plant is contemplated.

Southern States

EAST DURHAM, N. C.—The Crystal Hosiery Mill Company is equipping its mill for electrical operation. Electricity will be supplied by the Cumberland Railway & Power Company.

COLUMBIA, S. C.—Contract has been awarded to J. T. Dabbs by the Home Light & Power Company for the construction of an addition to its plant, to cost $40,000.

COLUMBIA, S. C.—Extensions and improvements to the street-lighting system, to cost about $20,000, are under consideration. W. H. Harth is electrician.

MOUNT CARMEL, S. C.—The Little River Light & Power Company, recently incorporated, is considering the erection of a dam and power house to develop 475 hp., to cost about $20,000, and also a 2-mile electric transmission line, to cost about $5,000. L. L. Hester is president.

SWANSEA, S. C.—Steps have been taken to organize a company to establish an electric plant to supply the town with electricity.

ELBERTON, GA.—The Elberton Oil Mills is contemplating the construction of a power plant. J. T. Dennis, Jr., is manager.

LULA, GA.—Plans are under consideration by T. C. Miller & Son to use electricity to operate its plant next year. The company generates its own power. H. C. Miller is manager.

PEARSON, GA.—Bonds to the amount of $30,000 have been voted for the installation of a lighting and waterworks system.

APALACHICOLA, FLA.—The construction of a municipal light plant is under consideration.

BRONSON, FLA.—The establishment of an electric light plant for municipal service is under consideration by the Bronson Manufacturing Company. I. P. Kimble is manager.

TAMPA, FLA.—Extensions to the electric lighting system are under consideration by the City Council.

NASHVILLE, TENN. — The Mohrlite Company of America, recently incorporated, contemplates the construction of a new plant, to cost about $300,000. W. M. Dixon of the Mohrlite Company of Urbana, Ohio, will be in charge of the Nashville plant.

BIRMINGHAM, ALA.—Surveys, it is understood, are being made by the Alabama Power Company for the erection of a transmission line from Auburn to Tuskegee; an extension of this line will provide service for Notasulga and other smaller municipalities.

BIRMINGHAM, ALA.—Horace M. Lane, 2320 Dime Bank Building, Detroit, Mich., is preparing plans for the proposed freight and car shop to be constructed for the Tennessee Coal, Iron and Railroad Company, at a cost of $2,500,000.

MONROE, ALA.—The municipal electric light and power plant, destroyed by fire on March 23 and rebuilt, is reported to have been burned a second time.

PICKENS, MISS.—The Town Council is considering issuing $10,000 in bonds for extensions to the electric light system.

HEBER SPRINGS, ARK.—The plant of the Heber Springs Light & Power Company, it is reported, was recently destroyed by fire, causing a loss of about $10,000. The plant is to be rebuilt at once.

LAVERNE, OKLA.—Plans are being prepared by the City Council for the construction of a new power plant, 30 ft. x 80 ft., to be used for municipal service. Arrangements are also being made for the installation of a local distributing system. Claude H. Arbuthnot, engineer, is in charge.

CORPUS CHRISTI, TEX.—Plans have been completed by the Corpus Christi Railway & Electric Light Company for the rehabilitation of its property, to cost about $125,000. A new thirty-year franchise has been granted the company by the City Commission.

DALLAS, TEX. — Extensive improvements are contemplated by the Nunn Electric Company to its property.

HOUSTON, TEX.—Contract has been awarded by the Mack Manufacturing Company to Thomas Tellepsen for the erection of a foundry, to be equipped with a 3-ton electric furnace, etc.

MARSHALL, TEX. — The Texas & Pacific Railway Company is changing the motive power of its local roundhouse and machine shop from steam to electricity. Additional equipment will be required. The works will not be completed for six months.

PHARR, TEX.—The electric light and power plant of the Pharr Mill & Elevator Company has been purchased by the Pharr Ice & Power Company. This company now furnishes electric and power service to San Juan and Swallow and contemplates the extending of its lines to other adjoining towns.

CONNELL, WASH.—The City Council is considering a proposal to issue $12,000 in bonds for the purpose of erecting a transmission line from Connell to Colotus, a distance of 15 miles.

HOQUIAM, WASH. — Grays Harbor Lumber Company is planning the construction of a sawmill to have a daily capacity of 1,400,000 ft. A new power house is to be erected to supply power to all of the company's industries.

SEATTLE, WASH.—The City Council has approved an ordinance which provides for extensions and improvements to the municipal electric light and power plant, to cost about $50,000.

TACOMA, WASH.—Petitions, it is understood, are being circulated requesting the City Council to install an ornamental lighting system on K Street, to cost about $13,000.

TACOMA, WASH.—Ira S. Davidson, City Commissioner, is reported to be planning the development of electric light and power in Pierce County, for which project bonds were voted last year.

YAKIMA, WASH.—Improvements to the local system, to cost about $30,000, are under consideration by the Pacific Power & Light Company.

KLAMATH FALLS, ORE. — W. B. Parker of the Klamath Development Company has purchased the property of the Keno Power Company, including the Klamath River power plant.

VICTORVILLE, CAL. — The Mohave River Irrigation District has voted to issue $5,000,000 in bonds to purchase and complete the Little Bear dam of the Arrowhead Reservoir & Power Company of San Bernardino. The plans provide for power development and distributing system to serve 27,000 acres. F. E. Trask, Central Building, Los Angeles, is engineer.

VISALIA, CAL.—The Southern California Edison Company of Los Angeles, has petitioned the State Railroad Commission for permission to take over and operate the system of the Mount Whitney Power & Electric Company, which operates in Tulare, Kern and Kings Counties.

LAYTON, UTAH.—The installation of a street-lighting system is under consideration by local business men.

SALT LAKE CITY, UTAH.—Petitions have been filed and have been referred to the city engineer for estimates on an ornamental street-lighting system for State Street, Broadway and Fourth South Street.

Canada

CALGARY, ALTA.—Tenders addressed to the City Commissioners, will be received at the office of J. M. Miller, city clerk, until May 14, for three 200-kva., 12,000-volt to 2,300-volt transformers. Specifications may be obtained at the office of the city electrical engineer.

EDMONTON, ALTA.—Tenders, it is reported, will soon be asked by the Hayward Lumber Company, 11904 Seventy-third Street, for the erection of a factory to cost $30,000, dry kiln to cost $10,000, and a power house to cost $12,000. E. W. Moorehouse, 11153 Sixty-fourth Street, is architect.

EDMONTON, ALTA.—A by-law to appropriate $500,000 for extensions to the city telephone system will be submitted to ratepayers. J. E. Lowry is superintendent of the city telephone department.

STOCKTON, MAN.—The sum of $150,000 has been appropriated for the construction of a dam at Stockton on which work will begin at an early date. The proposed transmission line will be erected along the Souris branch, east, until met by the line now being constructed from Portage to Carman and west as far as Souris.

WINNIPEG, MAN.—Contract has been awarded by the City Council for the construction of an extension to the power house at Point du Bois to Thomas Kelly & Sons, at $198,334.

WINNIPEG, MAN.—Tenders addressed to the chairman committee on fire, water, light and power will be received at the office of C. J. Brown, city clerk, until May 3, for furnishing and delivering cast-iron pipe and specials, cast-iron pipe transformer, rails and accessories for extension to the power house at Point du Bois. Specifications may be obtained at the office of the city light and power department, 54 King Street.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, Nepecnauk Bldg., 63 East Adams St., Chicago, Ill. Annual meeting, St. Louis, Mo., May 10 and 11.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, White Sulphur Springs, W. Va., June 29-July 2.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting, Asbury Park, N. J., June 22-25.

AMERICAN WELDING SOCIETY. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, W. J. Tharp. Little Rock, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York City.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill. Annual meeting, Chicago, Ill., Oct. 28-31.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, Vancouver, B. C., Oct. 19.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Power Company, 12 Adelaide St., East, Toronto, Ont.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, F. O. Safford, Denver Gas & Electric Co., Denver, Col. Annual convention, Glenwood Springs, Col., September.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City. Annual meeting, White Sulphur Springs, W. Va.

COMMERCIAL SECTION, N. E. L. A. Secretary, R. H. Tillman, Baltimore, Md.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-Treasurer, E. Donald Tolles, 52 Broadway, New York City.

ELECTRIC FURNACE ASSOCIATION. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill., Annual meeting, Del Monte, Cal., May 12-14.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill. Annual convention, Chattanooga, Tenn., May 5-8.

ELECTRIC VEHICLE SECTION, N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria Street, Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Arthur J. Binz, Houston, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich. Annual convention, Ottawa Beach, Mich., Aug. 24-26.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo. Annual convention, Jefferson City, Mo., June 3-5.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Annual convention, Baltimore, Md., Oct. 6.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive assistant to president, M. H. Aylesworth, 29 West 39th St., New York City. Annual convention, Pasadena, Cal., May 18-21.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. H. Conlee, Nebraska Gas & Electric Co., Beatrice, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, Kineo, Me., Sept. 14-16.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTH CENTRAL GEOGRAPHIC DIVISION, N. E. L. A. Secretary, M. Barnett, St. Paul, Minn. Annual convention, Minneapolis, June 16 and 17.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION, affiliated with N. E. L. A. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, Ohio, July 13-16.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Rialto Bldg., San Francisco, Cal. Annual meeting, Hotel Del Monte, Del Monte, Cal., May 17, 18.

PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual Meeting, Ann Arbor, Mich., June 29-July 2.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex. Annual convention, Galveston, Tex., May 13, 14 and 15.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

TECHNICAL AND HYDROELECTRIC SECTION, N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

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TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual convention, Atlanta, Ga., May 19-21.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

(Issued April 13, 1920)

1,336,414. TELEGRAPHY; John H. Bell, South Orange, N. J. App. filed Aug. 14, 1918. Prevents wandering-zero effects in conductors having high electrostatic capacity characteristics.

1,336,416. REGULATOR FOR ELECTRIC GENERATORS; Henry E. Borger, Newark, N. J. App. filed May 8, 1918. Cam-type regulator for automobile generator avoids use of batteries.

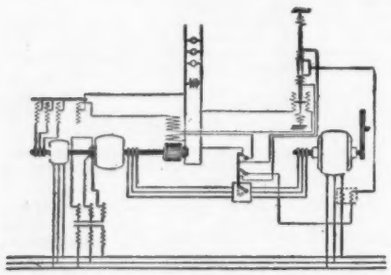
1,336,424. TESTING DEVICE; Maxwell W. Davis, West Haven, Conn. App. filed April 14, 1919. Portable flashlight tester.

1,336,431. COMBINATION SOCKET AND ADAPTER; William Halter, Cleveland, Ohio. App. filed March 9, 1918. Receives interchangeably either threaded base of a lamp, a threaded plug or a rectangular or non-circular push plug.

1,336,437. ELECTRIC-CABLE-CONNECTING MEANS; John M. Kiefer, Jr., Newark, N. J. App. filed June 21, 1918. Used with ignition generator.

1,336,475. ELECTRICAL CONNECTOR; George A. Mead, Mansfield, Ohio. App. filed Jan. 5, 1918. Bond with proper proportioning of parts attached to the rail by use of heating flame of 4,000 deg. Fahr. temperature and upward.

1,336,488. CONTROL SYSTEM; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Nov. 4, 1914. For rotary converter.



No. 1,336,566. Speed-Control System for Induction Motors

1,336,497. RECEIVER MOUNTING FOR SUBMARINE SIGNALS; Edward C. Wood, Somerville, Mass. App. filed May 18, 1918. Microphone mounted, so that undesirable lateral vibrations are largely eliminated, and microphone vibrations amplified.

1,336,502. RAIL BOND; William P. Bovard, Mansfield, Ohio. App. filed Nov. 2, 1917. Ferrous terminal member interlocked with body member by the compression of varying degrees of intensity to give high efficiency.

1,336,503. CATENARY SUSPENSION SYSTEM FOR ELECTRIC RAILWAYS; John R. Brown and Glenn H. Bolus, Mansfield, Ohio. App. filed Sept. 12, 1917. Insures high-speed service without hard spots and without danger of falling wire by having trolley suspended from messenger every few feet by continuous auxiliary messenger zigzagging from trolley to messenger and attached by trolley clips and by Crosby clips.

1,336,504. CURVE PULL-OFF HANGER; John R. Brown, Mansfield, Ohio. App. filed Oct. 18, 1917. For suspending wires around curves without subjecting the wires to twisting strains.

1,336,506. BATTERY CELL AND VENT MEANS THEREFOR; Campbell C. Carpenter and Roy J. Ellis, Niagara Falls, N. Y. App. filed April 6, 1916. Minimizes escape of electrolyte and permits escape of gases.

1,336,519. ELECTRICALLY OPERATED VIBRATORY MOTOR; Charles J. Henschel, Brooklyn, N. Y. App. filed Feb. 28, 1919. Armature mounted upon a pivot vibrates by attraction and release of an electromagnet.

1,336,520. PROTECTING MEANS FOR DYNAMO-ELECTRIC MACHINES; John H. Hertner, Lakewood, Ohio. App. filed June 5, 1918. Prevents injury to shunt-field coils when run on an open circuit.

1,336,544. ELECTRIC GENERATOR ATTACHMENT FOR WINDMILLS; Vernon L. Sullivan, El Paso, Tex. App. filed Feb. 12, 1919. Runs small electric motors, electric lighting, etc., and stores energy in battery.

1,336,559. ELECTRIC INTERNAL TUBE HEATER; Herbert Gutzwiller, Schonenwerd, Switzerland. App. filed Aug. 7, 1918. Heater with independent heating elements capable of being moved outward radially by means of a spreading-out device.

Record of Electrical Patents

Notes on United States Patents

1,336,561. SYSTEM OF MOTOR CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Oct. 7, 1915. Control of alternating-current compensated, commutator-type motors.

1,336,562. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 27, 1916. Regenerative operation for vehicles.

1,336,564. MECHANICAL RECTIFIER AND MEANS FOR IMPROVING THE OPERATION OF THE SAME; Oliver S. Jennings, Wilkinsburg, Pa. App. filed March 2, 1917. Mechanical rectifier, both self-starting and self-synchronizing.

1,336,566. SPEED-CONTROL SYSTEM FOR INDUCTION MOTORS; Benjamin G. Lamme and Wilfred Sykes, Pittsburgh, Pa. App. filed May 2, 1918. Flexible and economical operation of large-size induction motors substantially free from surging and allied harmful phenomena.

1,336,587. INCANDESCENT ELECTRIC LAMP HOLDER; Pierre M. R. Salles, Cauderan, France. App. filed Feb. 18, 1918. Combined wire-gripping and terminal piston-holding member consists of a sleeve having contracted open ends.

1,336,603. ELECTRODE ADAPTER; Ralph Baker, Wilkinsburg, Pa. App. filed Nov. 16, 1918. Carbon electrode of large diameter used with an electrode holder having an electrode receiving opening of small diameter.

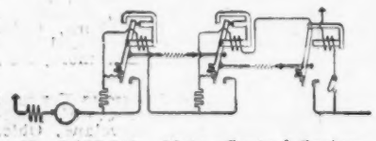
1,336,607. ELECTRIC LAMP SOCKET; Reuben B. Benjamin, Chicago, Ill. App. filed Jan. 29, 1915. For use with feeder consisting of an inner insulated conductor and an outer bare grounded conductor.

1,336,608. ELECTRICAL CONNECTING DEVICE; Reuben B. Benjamin, Chicago, Ill. App. filed Sept. 13, 1918. Screws into an Edison lamp-receiving socket and receives a lamp plug of Edi-Swan type.

1,336,611. ELECTRICAL MEASURING INSTRUMENT; William M. Bradshaw and Walter G. Mylius, Wilkinsburg, Pa. App. filed July 12, 1915. Records periodic demands for power.

1,336,615. TOLL TRUNK CIRCUIT; Ormond F. Cassaday, Chicago, Ill. App. filed Dec. 6, 1915. Trunking incoming toll calls by a local operator direct instead of having toll operator extend connection to a local operator.

1,336,619. ELECTRIC SYSTEM; John L. Creveling, Tucson, Ariz. App. filed Oct. 7, 1916. Field strength of spark-producing dynamo at times to be great and at other times weaker for speed regulation.



No. 1,337,040. Motor-Control System

1,336,728. RIPENER FOR MOTHER STARTER; Niels Christensen, Lima, Ohio. App. filed Oct. 5, 1918. Even temperature by resistances makes it possible for preparation of a pure lactic ferment culture to be kept indefinitely.

1,336,736. INCANDESCENT LAMP SOCKET; Witter W. O. Fenety, Fredericton, N. B., Can. App. filed March 9, 1918. Molded from single piece of porcelain.

1,336,764. ELECTRICAL APPARATUS; William I. Thomson, Newark, N. J. App. filed Feb. 16, 1917. Permits rapid charging of storage battery without injury to accompanying devices.

1,336,765. PROCESS OF RECOVERING COBALT; Marvin J. Udy, Kokomo, Ind. App. filed Aug. 14, 1919. Oxidizing roast to produce soluble sulphates, which are brought into solution and converted into basic form, the basic material being used to replenish a metal-depositing slightly acid electrolytic bath operating with an insoluble anode.

1,336,795. AUTOMOBILE SIGNAL; Joseph Svaigel, Detroit, Mich. App. filed June 13, 1919. Electrically operated tubular signal arm carried by a cross head.

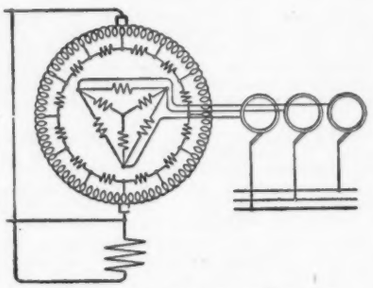
1,336,801. ELECTRICAL CONNECTOR; Clifford R. Wassell, Chicago, Ill. App. filed May 4, 1916. Two separable elements enable circuit changes to be made.

1,336,807. ELECTRIC FURNACE; Leone Almagia, Cornigliano Ligure, Italy. App. filed Sept. 23, 1918. Controls heat distribution and gives instantaneous automatic regulation of short-circuit points.

1,336,820. ELECTRIC FURNACE; Edwin L. Crosby, Highland Park, Mich. App. filed May 3, 1918. Inclosed refractory cylinder type.

1,336,833. RADIO-TELEGRAPHY; Leonard F. Fuller, San Francisco, Cal. App. filed May 21, 1917. Arc radio transmitter including a Poulsen type generator.

1,336,850. CONNECTOR FOR ELECTRICAL CONDUCTORS; Hosea F. Maxim, Norfolk, Va. App. filed March 19, 1913. Spring clip comprises two parts, one to be attached to carbon terminal, and a spring lever which grips a wire firmly in body part.



No. 1,337,071. Transforming and Converting Apparatus

1,336,859. TELEPHONE CORD; Anthony Reihing, East Toledo, Ohio. App. filed Oct. 15, 1919. Prevents twisting and breaking of cord.

1,336,889. SELECTIVE SIGNALING AND TRAIN-STOP SYSTEM; James R. Coker, Knoxville, Tenn. App. filed Sept. 25, 1915. Double-acting selector mechanism functions either as a telephone signal alone or as a combined telephone signal and train-stop mechanism.

1,336,894. ELECTRICAL TRANSFORMER; Sebastian Ziani de Ferranti, Baslow, Eng. App. filed Feb. 1, 1916. Winding held against seatings by resilient members so that no reversal of thrust takes place on occurrence of an excessive current.

1,336,918. RHEOSTAT; Antonio Papini, Philadelphia, Pa. App. filed Aug. 28, 1919. Regulates current from zero to the maximum available.

1,336,919. CURRENT-REGULATING PLUG AND SOCKET; Antonio Papini, Philadelphia, Pa. App. filed Oct. 13, 1919. For medical batteries or other devices.

1,336,928. METHOD AND APPARATUS FOR ALIGNING WORK ON V-BLOCKS AND THE LIKE FOR MAGNETIC CHUCKS; Frank L. Simmons, Woonsocket, R. I. App. filed May 10, 1919. Apparatus for aligning work upon magnetizable V-blocks or parallel bars.

1,336,929. TELEPHONE-RECEIVER HOLDER; Charles F. Simpson, Oakland, Cal. App. filed Sept. 10, 1919. U-shaped shoulder member with receiver resting against ear.

1,337,040. MOTOR-CONTROL SYSTEM; Eugene R. Carichoff, Schenectady, N. Y. App. filed May 6, 1918. Circuits controlled by electromagnetic switches which operate automatically in succession.

1,337,071. ELECTRICITY, TRANSFORMING AND CONVERTING APPARATUS; Henry M. Hobart, Schenectady, N. Y. App. filed Sept. 21, 1916. Electrical apparatus for receiving high-pressure polyphase current from a supply system and delivering relatively low-pressure direct current to a distribution system.